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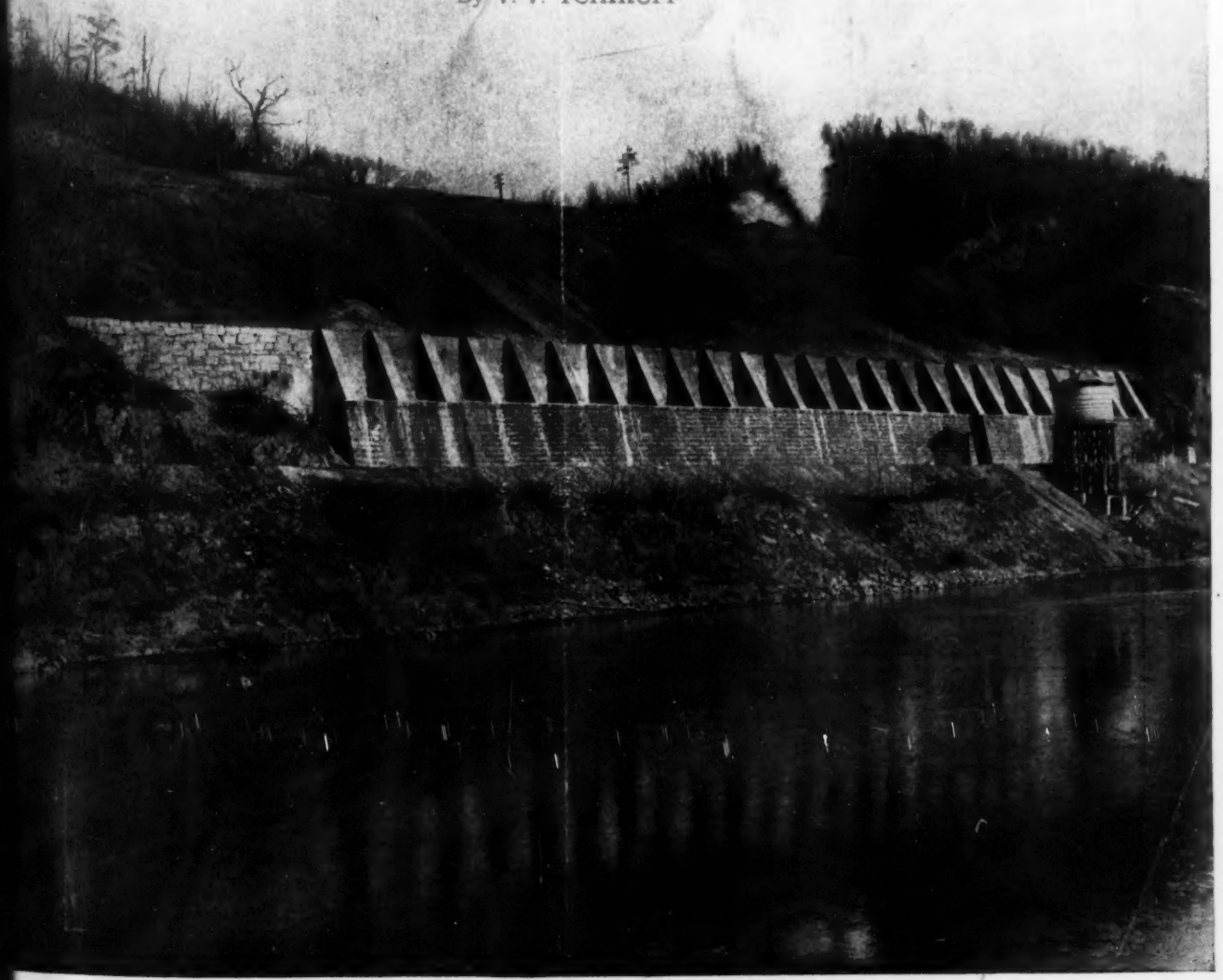
Successful Use of Detail-Drawing Method by a Puget Sound Shipyard

Comparison of Cost of Light and Heavy Equipment on Sewer Construction
By RALPH H. BURKE

Irrigation Opportunities in Russia
By V. V. TCHIKOFF



Concrete Buttresses Reinforce Bulging Retaining Wall Under High Fill

Cleveland celebrates Nov. 11th on Kreolite Lug Wood Block pavement.

MAYOR IS SERENADED

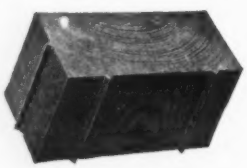
Revelers Stage Impromptu Stage for Benefit of Executive.

Serenading Mayor Davis was popular downtown yesterday.

A steady stream of serenaders all day wended their way to the city hall over a score of these gatherings were addressed by the mayor. Among them were those of the Higbee Co., Glenn L. Martin Co., American Shipbuilding Co., American Steel & Wire Co. and the Ohio Forge Co.

The police band and Robertson's band played at intervals during the afternoon before the city hall. Many in the crowd listening to the music danced on the wood block paving.

CLEVELAND PLAIN DEALER NOV. 12



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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

Volume 82 — NEW YORK, THURSDAY, JANUARY 23, 1919 — Number 4

Sanitary Problems in Burma Solved by American Engineer

TACKLING the sanitary problems of a mining camp in an Indian jungle has recently fallen to the lot of a young American engineer. He tells his own story on p. 172. Mosquito control, water-supply, waste disposal, are some of the problems which he was called upon to solve under unusual conditions, which may fall to the lot of almost any enterprising American engineer in these days.

Irrigation Extension Needed in Russia

IRRIGATION opportunities in Russia, set forth by an experienced engineer on p. 191 of this issue, are large. When order and industry are once more restored in that great country, irrigation will demand a large share of attention. Enough has already been done to point the way, but as yet only a beginning has been made. Besides contributing to the food supply of its own country and the world, the extension of irrigation in Russia would supply needed cotton for Russian spindles —a fact of great economic importance to Russia.

Public Works As Memorial Structures

FROM several quarters comes the suggestion that important public-works engineering structures about to be built might be planned and dedicated as memorials to our soldier dead. It is a bold suggestion, for commonly the works of the architect are alone held to be suitable for memorial use, and age-long custom requires structures of purely monumental character, free from all element of service. Yet there is distinguished precedent for utilitarian structures—not merely memorial fountains, but even a memorial bridge. What structure, indeed, can more truly carry out the mission of holding constantly before the people's thought the spirit of memorial dedication than a great, enduring public work that enters into the daily life of ourselves and our children? Public service and public remembrance may well be joined; service will but grace the memorial and make its message more eloquent.

Research Work Results Should Not Be Scrapped

HEARTACHES have been caused by the abandonment of all sorts of war work without provision for preserving, much less completing, valuable data accumulated or being amassed through various kinds of research work. The heartaches will end, but the data will be forever lost. Can nothing be done to save and utilize this material? Might not much of it be turned over to permanent Government bureaus for completion, where that is needed, for digest and publication? Most Government agencies will prepare histories of their activities. In many cases, though, more is needed, for useful developments have been cut off just as they begin to give high promise. There is an obligation in such cases to the public which paid for the work, to see that it is passed over to some agency, private or public, so that the investment already made will be conserved.

Hammering Forms a Useful Development in Concrete

THE VIBRATION of the forms with an air or electric hammer during the placing of concrete is responsible to a considerable degree for the complete filling of the forms in the new Government concrete ships, and the consequent desirable density of the concrete. There is no reason why this development should not be extended to all kinds of structural concrete work, where somewhat similar form and reinforcement conditions prevail. The tendency to use a dangerously wet mix is due mostly to the desire to insure a concrete which will run around all steel and into the uttermost corners of the form. In the ship concreting it has been found that the constant hammering on the form when concrete is being poured sets up a vibration which with certainty fills the forms and possibly gives a denser mix. Well directed hammering serves every end formerly achieved by slicing or tamping, and in addition leads concrete by no means wet around bends and angles in forms in a manner not possible by any other method. Building and bridge contractors would do well to look into the possibilities of the mechanical hammer for their work. Skill is required in its use. The vibration of concrete already beginning to set is dangerous, and there is the possibility, in joining new concrete to that already some hours old, of pushing out the form and permitting an over-run down the face. But knowledge of such things come with practice. The use of the hammer is undoubtedly a valuable byproduct of our concrete-ship experience.

A Suggested Use of the Army Bases

FREE ports are recommended by the report of the Tariff Commission noted on p. 206. Leaving aside the question of the economic or political desirability of such an innovation, it so happens that physically we are better prepared to attempt the experiment now than we ever were before. At six of our large coast cities—Boston, New York, Newark, Philadelphia, Charleston and New Orleans—the Army is just completing large

port terminals with warehouse and wharf equipment. of a size and coördination unprecedented in this or any other country. Except for an unforeseen calamity, the reason for these immense units will have ceased to exist within the year, and the problem of their utilization will be added to the other burdens of the Government. What better layouts could be found for a free zone or port? Each terminal is Government property, on deep water, readily subjected to that physical control necessary to the free-port idea. Each one is provided with the necessary wharves to and from which material can be handled to ships, and the connected warehouses easily converted into the factories which are a part of a free port. Finally, they have the railroad connections over which may be brought in such domestic products as are needed to complete the manufactured article for re-export. Free zones must necessarily be subject to test before extensive adoption. The experiment may be made most cheaply in one of the new Army bases.

Time Spent in Port Increases Shipping Costs

"I DO not know whether we can build ships as cheaply as they can in Europe, but I do know that if we try we can handle freight more cheaply, and on the proper development of this handling hangs the success or failure of the American merchant marine." Thus spoke Secretary of Commerce Redfield at a meeting of handling-machinery men last week. His words are apt to suffer the neglect common to the obvious, but they are no less forceful for that. Current concern over the future of our merchant marine revolves around the cost of shipbuilding and the wages of seamen, in neither of which is it probable that America can—or, being able, wants to—compete with Europe, with its low-priced labor. But in handling the freight to and from the ship we have a problem peculiarly fitted to our national genius. If American ships are so designed, equipped and operated as to require a turn-around in port half that of foreign vessels, we can laugh at their savings in overhead, for it is not the cost of operating a ship that makes freight rates; it is the cost of its idleness. So, to reduce the time in port requires much more than mere mechanical fitting of wharf and ship. It means a fresh view of the whole transportation problem, a revised design and operation—from the sources of material up to the hold layout of the ship itself—and an education of the men to the advantages they will gain from the rapid turn-around. That engineers in hitherto unthought-of numbers are working on this complex problem indicates a new attitude of mind, which can but result in a successful solution, provided legislators and lay executives have the courage to break the new paths that will be laid out for them.

New Blood in the Shipyards

IN NO one other point is the development of our newly created industry of shipbuilding during the past year of stress more significant with respect to future growth than in the influx of new men into the shipyards. Managers and workmen have been recruited from other walks of life. From the ranks of civil engineering and construction came what we believe to be the most important contribution. But all serve to strengthen the yard spirit; it is the new men that are taking hold best in the shipbuilding work, a yard manager tells us. His explanation is that old-time shipbuilders are one-boat men; their minds are not sufficiently open to the requirements of a new era in the art. It is the prime value of the influx of new hands and brains and ways of thinking that precedent, the mere following of tradition, will have less sway over our shipyard work in the coming development. Though the serious man-power shortage in the shipyards which prevailed and still continues makes a present survey of conditions less definite than could be desired, yet the conclusion is clearly justified that the new men, the new supply of energy, will carry the shipbuilding industry forward to new accomplishments.

Delayed Transit Planning and Growing Problems

RESUMPTION of municipal development after the interruption due to the war finds the problems of transit improvement presenting a changed aspect. While planning was halted and set back, city populations continued to grow, and transit needs became more urgent because of the resulting increase of congestion. The problems put to the engineer have thus been made more immediate, affording less time for study and analysis. They call for earliest possible resumption of transit planning.

Before the war, rapid-transit projects had reached an active stage of development in such cities as Detroit, Cincinnati, Pittsburgh and Cleveland. In a number of others, however, traffic conditions were approaching that point where remedial action must be initiated. These problems of transit shortage still exist, each one having been made measurably more difficult by the lapse of two years. But shortage is not the only factor in the transit situation today, for the conditions that have developed in the street-railway industry present fresh problems to the city and to the engineer. Cities that have heretofore studied rapid transit alone may need to review their work with regard to coördinating surface and rapid-transit transportation. Others, which have not yet outgrown the range of surface carriage, confront new opportunities and new obligations in study of the relations between city development and transit plan.

It is certain, then, that transit study is today a subject of broader scope than before the war, and that it affects the nation's city populations in quite remarkable degree. Moreover, its problems are now exceptionally urgent, and must be accorded a high degree of priority in the scheduling of public works. Further delay in planning is certain to accentuate the seriousness of each problem concerned.

Rapidly increased outward expansion of cities may be expected in the immediate future. During the war the stagnation of building operations hemmed in territorial growth, so that a nation-wide housing shortage developed. There is sure to be a reaction from this restraint. It will mean abnormal spread of the populated areas of cities and, in turn, greater transit needs. With this prospect, we may see even more clearly the imperative need for setting about the study of transit matters at the earliest possible moment.

Progress in Engineering Society Organization in 1918

THERE has been developing for years a healthy dissatisfaction with the organization of engineering societies. The older men have long declared that the engineer should be an influential member of the community; witness, for example, the repeated statement of this view in presidential addresses before the American Society of Civil Engineers. But the older men have been content with statement only. They and the leading engineering societies have apparently lacked the incentive to crystallize their statements into a program and to create machinery for the realization of that which they had so well expressed.

The younger men, however, were not content with high-sounding declarations on state occasions. They expected service from their engineering societies, and, in addition, flexibility and virility. They voiced their impatience, and as a result virile local societies appeared in various sections of the country.

Until the year 1918, however, there was no evidence that the recognized leaders of the profession took seriously the dissatisfaction or were openminded on the proposals for remedying the conditions against which there was complaint. With this year came a change. The fresh thinking stimulated by the war, but even more the constant pounding of those who demanded a new vision, has stirred the conservatives to action, so that even in New York, the rallying ground of the standpatters in engineering society organization, one daily meets former conservatives who advocate more active society organizations. Some few particularly honest ones even state that they have had a change of heart, though most of them try to forget their former league with inaction. The tangible evidence of the new spirit is the very hopeful view generally taken of the prospect for results from the Committee on Development of the American Society of Civil Engineers.

The change in attitude in the conservative East does not mean, of course, that the battle for virility in society work is won. New plans will require new machinery, new machinery will require new men. The victory proceeds so far only to the undertaking of the plans. There must be discussion and agitation, that this planning be well done. Then, when the planning is properly completed there will be needed more agitation and more pressure, that the machinery may be adequate and the men in charge in full sympathy with the plans.

While the ultimate form and aims of engineering society organization cannot be predicted in detail, there has been enough crystallization to show unmistakably the main character of the results. Possibly the most striking bit of evidence of the new aims is afforded by the resolution of the civil engineers' development committee—a resolution, we take it, intended to set the course for the committee's work. It was the sense of the committee, so the resolution declared, that the American Society of Civil Engineers "should adopt the principle of becoming an active national force in economic, industrial and civic affairs." The committee further recommended that the engineering profession establish offices in Washington "charged with the duty of keeping fully advised as to all matters in which the engineering profession should have a voice." Since the resolution was passed the Engineering Council has decided to open an office for just that purpose in Washington.

We are, then, safe in assuming that the engineering society organization of the future will take full account of the engineer's civic obligations. The selfish purpose, voiced now in constitutions of the national engineering societies, has given way to enlightenment.

As to form of organization, we can predict with certainty that it will be democratic. Autocracy in engineering society management is disappearing as surely as the dynasties of Middle Europe, and with its disappearance will go that inflexibility, that indifference to the needs of the individual engineer which has cursed the larger societies and driven many prospective members from them. In this connection we cannot refrain from quoting from an editorial on the American Society of Civil Engineers in *Engineering Record* of Jan. 16, 1915, four years ago.

"Present tendencies in every field" said the editorial, "are toward democratization. The cry against autocrats was louder than the first rumble of the European war. The wise corporation official has changed his motto to read, 'The public be pleased.' Industry's tyranny over the individual has been broken by workmen's compensation acts. Coöperation, fellowship, representative rule, are succeeding the cruder forms that preceded.

"The movement in the American Society of Civil Engineers is of the same order. In a small way it mirrors the large swing of world events and race tendencies. Its ultimate results none can doubt. It behooves those who have placed the society on its present eminence, and have made it financially impregnable, to take hold in the new spirit, that the society may broaden and grow, grasping the larger opportunities which a more complex age is placing before it."

The quotation is indicative of the signs long ago apparent to those who would see.

One further result seems to be foreshadowed, though the signs are still too nebulous to predict either the time or the detailed nature of the result—the heading up of all societies in one widespread clearing house, so that unified professional action may be secured. The Engineering Council, hampered by its form of organization, is nevertheless making headway. The civil engineers' development committee is keeping in touch with similar bodies in other societies, while a number of plans for centralization have come from various sources. All indicate the widespread determination that there shall stand before the public one engineering profession, and not isolated local organizations or bodies of civil, of mechanical and of other specialized engineers.

Viewing engineering society organization broadly, then, one can feel satisfied with the year 1918. There has been greater progress—or at least greater visible progress—than in any other year in the memory of living generations. What has developed is but a start, it is true, but a most encouraging one. There is as yet but little result, and since there are still many standpatters and much inertia there can be no relaxing by those with high vision and purpose. The skirmish only is over; the full victory is far from won.

Sanitary Engineers Get Direct Results In East Indian Mining Camp

Experience at Namtu Is Typical of Tropical Sanitation In Rural India—Jungle Cleaning and Drainage Are Successful Measures in Mosquito Suppression—Local Conditions and Habits

By Harry N. Jenks
Sanitary Engineer, Burma Mines, Limited, Namtu, Burma

MOSQUITO control and camp sanitation through the works and follow-up operations of the engineer are effectively preserving the health of Europeans and natives in the jungles of India. Intensive clearing and drainage—utilizing cheap labor rather than oiling on account of the expense of the latter—are the principal methods used by the Burma Mines, Ltd., at the frontier town of Namtu, in the Northern Shan States, Burma. Camp sanitation problems also include water-supply, sewage and refusal disposal (conservancy) and general sanitation. The camp is on the Namtu River, 550 miles from Rangoon, in a region of irregular topography varying from 1755 to 2100 ft. above sea level. Until 1911, when the smelter was moved from Mandalay to Namtu, nothing was done in the way of sanitation beyond the barest necessities. However, with the establishment of the smelting works and refinery, together with the accessory plant and shops, this village was made the center of the company's activities, and the attendant rapid growth of the camp made it necessary to provide a satisfactory water-supply and adopt a system of conservancy. A few house and street sweepers were employed to care for the bungalows and compounds, while a small force was engaged in removing and burying in trenches the night soil from the camp. By this time also the jungle had been cleared of the larger trees, for use as timber and firewood, thus affording relief from the previous almost nightly maraudings of tigers and cheetahs, diminishing greatly the danger from snakes, and making it decidedly more convenient to get from one part of camp to another.

THE RAILWAY STATION COMMANDS A VIEW DOWN THE NAMTU RIVER VALLEY

By 1913 Namtu had grown to be the most important mining camp in the country. Native labor from distant provinces and from China began to appear in great numbers, and, next to Rangoon and Mandalay, Namtu contained the largest group of European residents in Burma. Realizing the importance of greater sanitary vigilance, in view of the increasing population, the company established a sanitary department to work in coöperation with the medical department, in guarding the health of the community.

The personnel of the medical and sanitary staff consists of one European sanitary engineer, two Indian sanitary inspectors, six compounders and dressers, two overseers, one sanitary sweeper, 30 hospital sweepers, eight conservancy sweepers and 20 coolies on jungle cutting and drainage.

Sanitary conditions in this mining camp may be taken as typical of the rural or jungle districts. In general the fight in the Indian municipality is mainly against plague, cholera and smallpox, while in the jungle one is face to face with malaria. By the individual sufferer plague and cholera are more to be dreaded than malaria, but it is questionable whether there is any other single disease in the tropics that causes a greater sum total of misery and human waste than malaria and malarial cachexia. In this respect, malaria is to the resident in the tropics what colds and grippe are to those in America, especially in the New England states. In spite of the drainage afforded by the steep slopes of the hillsides of this region, the inevitable small collection of water in paddy fields and along the banks of the more sluggish streams have always furnished breeding places for mosquitoes. Even in the hills malaria may abound, because the rank growth of jungle impedes the surface run-off and thus allows mosquitoes to breed in every available hollow, as well as in the accumulations of water found in the stalks and among the leaves of the undergrowth. Many coolies coming from the jungle stations along the railway act as malaria carriers, so that in interpreting our malaria statistics a careful distinction must be made between local and imported cases.

Water for the European side of camp is derived from springs in a swampy area. It is collected in open ditches leading to an earth-lined reservoir 30 ft. square, in which it is impounded to a depth of 8 ft. by a concrete dam. The water is carried down the hillside in a 4-in. pipe, passing through two pressure-break reservoirs on the way, and is then distributed throughout the camp by pipes of various sizes. The source of supply is protected naturally by its remoteness from human habitations and by its position near the top of the slope. In this connection it should be noted that typhoid fever is practically unknown in this region.

For conservancy purposes the latrine-trenching method of the disposal of excreta has been adopted. Sanitary practice in India has in general favored the

latrine in its various modifications as a solution of this problem. In justice to a system which in America has been practically abandoned in favor of the water-carriage system, it must be admitted that here in India it serves its purpose surprisingly well. The people are disposed to use the latrines, and a plentiful supply of labor is at hand to attend to them. In Namtu the wet-pail system is used, the night-soil being removed twice daily by bullock carts to the trenching grounds a mile away from camp, and there buried.

On the smelter side, owing to the absence of cart roads, the pails must be carried to the trenches near at hand, though far enough away to avoid local nuisance. In order to obviate further expense in this respect, sanitary privies are now being built instead of pail latrines. In the bungalows themselves, the use of commodes, which are emptied and cleaned twice a day by the house-sweeper, is found to be entirely satisfactory both from a sanitary and sightly standpoint.

Of many limitations to the applicability of the latrine-trenching system to the problem of conservancy, one of the most obvious is that it does not provide for the disposal of waste water from house baths and kitchen sinks. In Namtu this waste water is discharged onto the ground and flows away from the house through small ditches running down the hillside. This involves expense and trouble in keeping the water from collecting in small depressions under the houses and thereby allowing mosquitoes abundant opportunity to breed on the premises. To overcome at one stroke the disadvantages of the existing method, the sanitary department has prepared a design for a comprehensive water-carriage sewerage system to serve 60 bungalows on the

THESE COOLIES CLEAR JUNGLE AT $1.50 PER ACRE

European side of camp, with a new European hospital now being completed.

The sanitary department maintains a squad of street-sweepers in the neighboring village of Pang Hai to coöperate with the local authorities in keeping the town clean. This is an important consideration in view of the fact that about a third of the 3000 coolies employed by the company live in Pang Hai and Ih Aung villages.

Prevalence of malaria throughout the region is the greatest detriment to health in Namtu. The extent to which it contributes to sickness among the company's workmen and staff is shown in the next column.

ROUGH TOPOGRAPHY IS FAVORABLE FOR DRAINAGE

In 1916 the total number of cases among the Europeans and Anglo-Indians decreased by 39% as compared with 1915. It was in 1916 that jungle clearing and drainage work was maintained with a thoroughness not attempted theretofore. The returns for the first

ANALYSIS OF MALARIA INCIDENCE, BASED UPON NAMTU HOSPITAL RECORDS

	1915		1916	
Number of Cases	Europeans and Anglo-Indians	Asiatics	Europeans and Anglo-Indians	Asiatics
Malaria	238	4,589	145	5,533
All causes	706	12,243	828	13,236
Ratio malaria to all causes	0.34	0.38	0.18	0.42

ten months of 1917 indicated that the total number of malarial cases for that year would be about 50% that of 1915. The increase in the number of Asiatic cases noted in the table is only apparent, and is due to the greater number of imported cases and patients who avail themselves of treatment at the company's hospital.

In the jungle itself the bamboo is regarded as the plant most responsible for the breeding of mosquito larvæ. Especially is this the case when the bamboos are cut, thus leaving a cup in each shoot in which the larvæ thrive. After the bamboos and larger jungle growth have been removed, the weeds and grass that spring up favor the development of larvæ by arresting the surface run-off of rain water. It seems probable that in Namtu the incubation period of the mosquito egg may, under favorable conditions, be as short as one day. In order that no small collection of water shall remain for more than a day after a rain, the grass on the hillsides throughout the camp is kept as low as possible, so that the surface drainage and evaporation may be materially hastened.

Prior to 1917 jungle-cutting was done by a gang of about 12 coolies by day labor. This was found to be unsatisfactory as regards both expense and quantity of work done, so that during 1917 the work was let out on contract, with a great improvement in rapidity and thoroughness. The tool with which the cutting is done is known in Burma as the dah, and is similar to the Cuban machète. The dahs vary in weight and form according to the character of the brush to be cut. For the grass-cutting work we use the Kachin pattern, which is long and light. The ground is too uneven for the use of scythes, but short sickles are em-

ployed to advantage on the tough wire grass that grows near the streams.

The usual method of oiling mosquito-breeding collections of water finds little application in Namtu. Aside from the almost prohibitive expense, there are no ponds of importance that do not receive a thorough flushing with every tropical rainstorm, so that in any case the oil would be promptly washed away.

Open ditches drain the few low-lying places, but these require constant cleaning to keep them free from a rank growth of weeds. It is proposed eventually to underdrain the swampy areas by the use of open jointed tile. The drawback to this is the expense, since in Burma all drain tile and sewer pipe is made on the potter's wheel.

Quinine prophylaxsis is not generally practiced here. It seems to be the opinion among the company's staff

IMPORTED COOLIES BRING IN MALARIA

that the possible injurious physiological effects of the drug when taken in the doses required to secure more or less complete immunity are more to be feared than the chances of getting malaria. The recommended dosage is 5 grains every other day during the monsoon season, or from the end of May to November. It is given in the sulphate form, in solution acidulated with citric acid. At the hospital quinine is dispensed in pill form to the natives.

In this remote corner of Asia the cost of supplies and materials of construction is comparatively high even in normal times, but now, due to war conditions, everything that must be imported has risen excessively in price, and many materials can scarcely be obtained at any price.

The following are now (November, 1917) a few typical prices of materials in Namtu: Sawn timber, $8 per ton of 50 cu.ft.; common red brick, $5.12 per 1000; portland cement, $6.40 per barrel of 3.8 cu.ft.; sand, $1.76 per 100 cu.ft.; stone, $1.60 per 100 cubic feet.

Such materials as earth, sand or stone are measured in cubic feet rather than cubic yards, because the former unit is more readily appreciated by the native contractors.

A recent quotation on sewer-pipe from Mandalay, the center of the ceramic industry, was 6, 10 and 12 cents per lineal foot for 4, 6 and 8-in. pipe respectively.

Wages paid coolies in the Orient are proverbially low, so likewise is the efficiency of the workmen. In India proper, coolies get from 4 to 6c. per day, but in Burma the wage scale is considerably higher. In Namtu the scale of daily wages for unskilled labor is as follows: Railway and maintenance-of-way, 20c.; all other work of a general nature, 24c.; work in the smelter, 32c. The average for such skilled labor as carpenters, pipe-fitters, masons, etc., is 80c. In terms of a day's work the above figures for unskilled labor correspond very closely with wages of $1.50 to $2 per day.

Recognizing the inferiority of day labor in India, it is the general custom here to have even the smallest piece of work done by contract. It is no uncommon thing to let a contract for a five-rupee ($1.60) job.

In Namtu contractors flourish because of the great amount of construction work that is being carried on throughout the year. The big jobs are handled almost exclusively by Chinese contractors, since the greatest proportion of construction is in timber, and all the carpenters are Chinese. Masonry work, which is next in importance, is given to Indians and Burmans, who have a monopoly in that trade. Much petty contract work is done by Burmese contractors, and very often some native foreman, or "coolie gong," will start in this business on his own account in order to make money without having to do any work himself, this being the height of his ambition.

Under average conditions, the cost of getting various kinds of work done by contract, inclusive of labor and supplies, is as follows:

Class of Work	Rate
Concrete and masonry	$32.00 per 100 cu.ft.
Brickwork	25.60 per 100 cu.ft.
Timber work	32.00 per ton of 50 cu.ft.
Excavation:	
Earth	0.24 per 100 cu.ft.
Loose rock	0.80 per 100 cu.ft.
Hard rock	1.60 per 100 cu.ft.

All new construction work undertaken by the sanitary department and nearly all of the jungle clearing work are now being done by contract, the latter being the largest single item in the operating expenses of the department. During the rainy season (May to November) it is necessary to go over the camp once every two months. Each cutting amounts to 160 acres on the European side of the camp. Under average conditions, the contractor will make a fair profit at $1.44 per acre. On a contract recently let to a Chinese 140 acres was cleared in 36 days, the average rate being 0.27 acre per coolie per day. On a previous contract undertaken by coolies from Orissa Province, India, 70 acres of jungle grass were cleared at the daily rate of 0.24 acre per coolie, but far more supervision was required than with the Chinese labor.

Those persons in America whose acquaintance with India has been gleaned from the fiction of poets and writers, who have sung the praises of India's mysterious charms, from the lovely vale of Kashmir to the golden Irawadi shore, will, if they chance to come to this country, feel under the necessity of applying a large correction factor to the sum total. The sanitarian is confronted with the problem of making what he *can* do measure up reasonably well to what he sees on every hand *ought* to be done. Since sanitary and public health work is essentially a personal problem, the habits and customs of the people whom such work is to benefit are the chief factors with which the worker has to concern himself.

It is axiomatic in the East that the native "workman" never does as much as he is paid to do. He is generally a living example of that otherwise highly useful theory in structural design known as "least work." To get more work out of him requires as much, if not more, energy from the outside in the form of active supervision than is obtained from him in return. Climate undoubtedly has been the most potent factor in arresting the development of the capacity for work on the part of the indigenous population. Namtu is more fortunate than many other places in India in possessing a climate that is about midway between temperate and tropical, although during the summer months the combination of 80° temperature, 80% relative humidity and 60 in. of rainfall approaches sufficiently close to tropical conditions.

Perhaps the most important of all the influences that govern the character and effect of the work done among the natives of India is the influence of habit. Habit is practically the sole arbiter in the lives of the entire population, in all that they do and will not do; and this ingrained force of habit attains its most far-reaching development in the caste system. This fact furnishes many novel problems to the sanitarian. The effect of the sanitarian's work upon the people of India is at one and the same time his chief reason for enthusiasm and despair. Considering the almost limitless field for his efforts and the beneficial results that appear when insanitary conditions are relieved ever so slightly, he is bound to be enthusiastic. On the other hand it appears at times an almost hopeless undertaking to attempt to make any real progress, in view of the magnitude and the difficulties of the task which confronts him.

Formation of Technical Sections Is Suggested

President A. N. Talbot in Annual Address Before American Society Advocates Changes in Present Machinery of Organization

REVIEWING the society's activities, already announced, during the past year, including the work of the Engineering Council (see *Engineering News-Record* of Jan. 9, p. 81), the retiring president of the American Society of Civil Engineers, Arthur N. Talbot, proposed several fruitful lines of development for the society, at the annual meeting on Jan. 15. The following abstracts from his address include the suggestions for more technical committees, for technical sections and for greater participation in public affairs.

The discussion of the purposes and functions of an engineering society, such as the American Society of Civil Engineers, should not be restricted to the purposes given in the constitution, which may merely follow precedent or may be worded to conform to a state statute governing the charter of the society. Some of the functions of the society, may it not be agreed, would include at least the following:

A collector and disseminator of engineering knowledge; a forum for the discussion of engineering questions; a stimulator of research and of the progress of engineering science; a developer of engineering methods and practice; an active force within and without professional circles; a creator of engineering policies and an originator and patron of constructive and progressive movements in engineering; a means of mutual helpfulness and coöperation; an instrument for advancing both professional interest and public welfare, and an agency for discussing the various phases of public problems and for participating in the service which all thinking organizations should give to society.

Technical Papers Not Sufficient

The technical activities of an engineering society are of prime importance—meaning by technical matters not merely mathematical methods and routine work of engineering, but all relations to the science and art of engineering in and out of professional circles, and also the technical relations with the public. One method of carrying on this technical activity has been the presentation and discussion of papers on engineering topics.

But is the society doing all it should in this direction? Is there not need for papers in fields not often taken up? Should there not be more short, terse papers, devoid of details, which should stimulate and set engineers to thinking? Would it not be possible and desirable to have more papers dealing with principles, with the advances of engineering, with new methods and requirements? May it not be worth considering whether to continue the policy of limiting ourselves only to those papers which are offered to the society, regardless of whether this policy leads to ignoring large fields and results in transferring to other societies the activities in these lines? Are there not opportunities for dissemination of knowledge like reviews of engineering construction and methods and digests of important engineering literature, which seem now not to have adequate expression through other agencies?

More Technical Committees Needed

Technical committees form one of the most effective means of carrying on the technical activities of an engineering society. They can coördinate and unify practice, develop methods, formulate principles and standards, and recommend improvements and advances in the art. Their influence can reach out far beyond the bounds of the society. For example, the American Railway Engineering Association has 23 technical committees, with a combined membership of 480, out of a total membership of 1100 in that society; the American Society for Testing Materials has 38 technical committees and 144 subcommittees, with a combined membership of 1094.

At the risk of seeming disloyal, the opinion may be advanced that in influence upon engineering practice, in effect in the industries, in influence upon relations of engineering business, in advancement of engineering knowledge and the methods of manufacture and construction, and in influence in the outside business world, the achievements of these two specialized societies in the past few years have been such as to make some of the national engineering societies look to their laurels for leadership. The Committee on Development will find the need and opportunity for technical committee work an important subject for study.

An opportunity for energized activities lies in the formation of specialized divisions or sections of the society, to give attention to special fields of work, such as railway engineering, structural engineering and hydraulic engineering. Members would enroll in sections in which they are interested. Sessions and convention would be held to discuss matters of common interest, and each division might affiliate in some way with the work of other societies—the American Railway Engineering Association, the American Society for Testing Materials, the American Public Health Association, for example.

Any attempt at organization of the profession throughout the country for all the national societies should involve joining forces with local societies in every possible way. In every center of engineering the local engineering society should be the basis of organization. Some plan should be devised, perhaps by increase of dues, to contribute revenue from the treasury of the national societies to the chapters for use in this union work with the local societies.

For certain purposes it may be found desirable also to have a regional organization covering territory corresponding to the geographical districts now used in the selection of the nominating committee, for handling matters of common interest in a given region.

The provision for a New York Meetings Committee to take charge of the second meeting of each month, made by the Board of Direction on the recommendation of the secretary, is a step in advance. It would seem to the president that in any new plan for local associations or regional organizations, the resident membership in New York should be granted some degree of autonomy by the formation of a local association or chapter, and that the New York membership should be set at work and stirred up to realize and utilize the opportunities and facilities at their door.

Relations With Other Societies

The four Founder societies have many activities in common. The Engineering Council may soon have its membership increased by three more societies. The Engineering Standards Committee will have the coöperation of a number of societies besides the four Founder societies. It is increasingly apparent that engineering is a single profession; the various branches ramify and merge into each other in numerous ways. Many engineers think there should be one large, inclusive society to take the place of the several national societies—to be made up of the 35,000 engineers in the four Founder societies or the 100,000 or 200,000 who may claim the right to be classed as engineers. The further union of national societies and their coöperation with the local societies in developing engineering society activity are potential factors for the future and a fruitful field for the Committee on Development.

The engineer and the engineering society now have opportunity and responsibility in the direction of public duty far beyond what they have hitherto considered as their share. This is especially true at the present time, when the successful solution of so many public problems lies within the province of the engineer. The consideration of quasi-public matters has not always been accepted as a proper field for society activity. As an illustration, the opposition to the creation of the Committee on Valuation of Public Utilities may be recalled. Fortunately, the advocates of the appointment of the committee prevailed, and a magnificent report and discussion were given to the public. Besides, the activities of the committee stimulated thought and provoked discussion throughout our membership as few subjects have done.

It would be premature to try to outline methods for accomplishing the great work in public matters which should be undertaken, or the form of organization which is needed. The formation of a large and representative Public Affairs Committee has been suggested, and also a delegate convention organized to discuss matters of public interest and intended as a forum for voicing the sentiments of the organization. Whatever is done must give opportunity for exercising initiative and providing powers for action. Leaders must then energize the machinery provided.

Use of Available Funds

The activities here referred to will require adequate funds; it takes money to do things in this world. If the activities of the society are to be extended funds must be provided, and part may well be taken from the annual balance of $20,000 or $30,000 which in normal years may be left after paying the expenses of present activities. It seems reasonable that a society which has become established financially should not continue to put aside from annual receipts very large sums as endowment; the increase in endowment may be expected to come from other sources. Increase in membership will bring increased revenue, and many believe there should be a considerable increase in membership.

If it is agreed that there are activities which the society should undertake for the benefit of the profession and society, activities that will bring results and that will help in making the society a force of greater and greater influence, who will doubt that resources will be found to finance the work?

To shun the visionary, impracticable schemes, and yet not be too complacent about past accomplishment; to seek to be national and not provincial; to try to be both democratic and efficient; to lead in the progress of the times, and yet hold to the old and proven good; to work to be a powerful engine in technical affairs and a vital force in the life of the profession; to learn how best to give service to the community and the nation; to provide methods by which the profession may lead in progressive movements—these are ideals worth striving for in making a plan.

It should be borne in mind, too, that elaborate or complicated organization is likely to be ineffective; the machinery is not self-propelling. Mere paper proposals will not suffice. Whatever is done we must keep down on earth, accept only workable plans, but still not be content with stagnation or mediocrity. A plan may be worked out befitting the needs of a great profession. With such a great opportunity before it I confidently expect the Committee on Development will evolve a plan satisfactory to the society, and that a stronger, more useful, more virile society will result. I confidently look forward to a great future for the American Society of Civil Engineers.

Defends Construction Division's Form of Contract

General Marshall Urges Engineers To Educate Those Who Would Not Permit It—Advocates League of Technical Societies

WIDESPREAD opposition to the well known Construction Division sliding-scale cost-plus form of contract is not based on a knowledge of its operation or advantages, said Gen. R. C. Marshall, Jr., head of the Construction Division of the Army, in an address before the annual meeting of the American Society of Civil Engineers Jan. 15. General Marshall also advocated an amalgamation of all engineering societies, at least to such an extent as to permit the dealing by the Government with a unit body of engineers. Parts of the address follow:

Popularly, the form of contract which the Construction Division has used is almost universally known as a "cost-plus contract," but this term is not, strictly speaking, exact. The contract which has been used from the beginning, with slight modifications in nonessential details, has been one in which the contractor was reimbursed the actual expenditures with a fee to him graduated on a sliding scale. The percentage he receives gets lower as the cost increases, and a maximum figure is set which his fee can, in no case, exceed, no matter what the cost of the work may be. Many reasons dictated the adoption of this form of contract, which, to all who understand the facts, has proved its usefulness and its value beyond the peradventure of a doubt.

Why the Contract Form Was Devised

Take for a moment's consideration the conditions under which the original camps were built. The Cantonment Division (which later was enlarged and developed into the present Construction Division) was told that in 90 days it must complete the following work: It must have quarters ready for the training of over 1,000,000 men; it must go upon 32 virgin sites and upon each one build a camp, equipped in all essential details, to house and accommodate a draft army about to be called to the colors. It must draw, coördinate and complete the plans, prepare specifications and contracts, select the contractors, organize field forces for them, appoint constructing quartermasters, supervising engineers, and attending organizations. It must see that material in immense quantities was forthcoming; it must foresee and solve the engineering problems involved, and it must build 16 cantonments, roughly estimated to cost $6,000,000 each, to house 40,000 persons each, and 16 tent camps at about half the cost of the cantonments, but to accommodate almost as many men. Rough building was not sufficient—roads must be laid out, water-supply and sewage problems developed and overcome, and the result must be, so far as public utilities are concerned, comparable, at least in efficient working ability, with those of a city of the same size; and all this in 90 days.

Could any other contract known to man, or which the ingenuity of man could devise, have taken care of this situation? The making of plans, the advising of engineering features, the procurement of material, the formation of the organization, and the building itself, had all to go hand in hand. The markets for material and labor were in a period of instability to an extraordinary degree, and no contractor on earth could have made an intelligent bid upon any one of these projects had he had plans and specifications upon which to base it. Nor, conversely, could plans and specifications have been furnished him had he been in a position to bid. Let me not be misunderstood—the sole justification for the cost-plus contract as used during the war is not the uncertain and unstable condition brought about by the war, for the cost-plus contract, properly administered, is the proper, conservative and just method of doing contracting work—just alike to the owner, the engineer and the contractor.

In this connection, I want to draw the attention of this audience to the trend of Congress in this matter, as indicated in two provisions of law. In the bill making appropriations for the support of the Army for the fiscal year ending June 30, 1919, Public No. 193, 65th Congress, the following appears:

> "Provided, That where practical so to do, no work be done or contract made under or by authority of any provision of this act on or under a percentage or cost-plus percentage basis, nor shall any contract, where circumstances so permit, be let involving more than $1000 until at least three responsible competing contractors shall have been notified and considered in connection with such contract and all contracts to be awarded to the lowest responsible bidder, the Government reserving the right to reject any and all bids."

Also an act to authorize the President to provide housing for war needs, Public No. 149, 65th Congress, Section 7, has similar provisions.

I cannot believe that this tendency of Congress has been brought about through any effort by this society, or any similar to it. I am convinced that the best thoughts are quite to the contrary. I do believe that these laws, and the similar talk in Congress, are brought about by the lack of effort on the part of this society and similar ones.

Attack on Emergency Contract

Education is, of course, the only remedy worthy the name for ignorance or for mistaken apprehension of facts. Through ignorance and through mistaken apprehension of the facts of the case, the emergency contract outlined above has been the subject of bitter attack from persons in and out of the Government service and from quarters high and low. Let me add that these attacks have, in my opinion, in most cases been sincere, but due entirely to a mistaken apprehension of the nature of the causation of the actual operations and of the results of these contracts. They have saved—and this is demonstrable—to the Government a vast amount of money. They have operated with smoothness, flexibility and with surprisingly little misunderstanding or friction between the Government and the many contractors in question. Without them the vast building program of the Army which has been successfully accomplished would have been a matter of utter impossibility.

But from the very fact that they have not been understood, that their nature is not clearly seen and that the people in general, including national legislators, have

not informed themselves concerning them, they are in bad odor in many quarters, and a more or less determined effort is being made to prohibit their further use. I trust it will not be presumptuous in me to say that I am satisfied that the remedy for this state of affairs is the education of Congress and of others who oppose this or other measures because they do not understand them, and this education should not come through the education of the people at large, and the consequent infiltration of the knowledge thus disseminated into the legislative brain; the process should be reversed. The men who make the nation's laws should themselves be informed of the truth, and in matters such as this it is the province of just such societies as yours to act as the educational agency.

Technical Societies Should Join Together

This brings me to another thought which I wish to urge to the earnest consideration of this audience. It is my belief that the dignity, the power, the learning and the history of accomplishment of the engineers of this country make them a factor in its future undertakings which must in time be realized and accepted by the Government. They should be gratefully and heartily accepted by the Government as a constructive force and as an instrument of accomplishment which, properly taken advantage of, will be second to none. But, in order that the fullest good can come from such a consummation, there must be the utmost harmony, the utmost flexibility and the most thorough coöperation among the engineers themselves.

In the building operations of the Construction Division, there has never been a time when the great engineering societies of this country have not been willing and eager to lend their assistance to the work of the division, each and every one of them, and I wish here and now to tender publicly my grateful and heartfelt thanks for this invaluable assistance extended so generously and so freely. But, in every case, the War Department had to treat with a number of more or less isolated societies. In union there is strength, and there is no axiom of the many which are so freely mouthed which is so true and so universal in its application as this one. Had there been amalgamation of these societies—a consolidation, if you will—a central governing body to which they were all subsidiary, or in some shape or form a coördination, a central direction, some one head to which they all looked and with which an outside agency could treat, the task of the War Department would have been infinitely simplified. I believe that for the greatest good of the engineers, of the Government and of the economic life of this country, some such arrangement will have to be made. Concerning the form or the method, I do not know and would not presume to advise. Concerning the wisdom of such action, I am as sure as I am of anything in the world, and I urge it upon you to consider it with thought and to make it an accomplished fact as soon as may be.

The experience of this work has shown the infinite wisdom of a close *rapport* between Governmental agencies and the large commercial and professional organizations whose aid must be enlisted at any time of national crisis. Such aid has been freely given during this war, but the method of effecting its greatest accomplishment has been hindered and hampered by the fact that the parties had, at first, to establish mutual understandings, to get each other's viewpoints and to adjust themselves to a changed and unfamiliar method of accomplishing results. There should be in the future, there must be, close touch and sympathy between such organizations and the executive departments of the Government. This, I hope, will be particularly the case with the membership of the engineering societies of America.

Director General Reviews Railroad Operation for Year

General Conclusions, and Figures Furnished on Operating Results—Reasons for Adoption of Standard Locomotives and Cars

REVIEWING the past year of railroad operation under Government control Director General W. G. McAdoo's report to the President outlines the accomplishments of the Division of Operation established Feb. 9, 1918, with Carl R. Gray as director. The difficulties in operation and the causes of congestion are enumerated, and methods of attacking the problems are presented. Abstracts are presented here of the sections on coal handling, unification of terminals, short-hauling of freight, and the standardization of locomotives and cars.

In addition, details from Mr. McAdoo's report to the Interstate Commerce Committee of the United States Senate, Jan. 3, on expenditures, on unification needs at Cincinnati, and on the elimination of circuitous routes, are included.

Causes of Railroad Congestion

The potent causes which produced serious conditions of congestion and resulted in the taking over of the railroads by the Federal Government were: (1) Accumulation of export freight at North Atlantic terminals; (2) shortage of motive power; (3) heavy building operations by different branches of the Government, the contractors for which ordered materials forwarded far in advance of their ability to receive and unload them (at one time over 5000 carloads of piling were tied up in the Hog Island shipyard); (4) feverish demands led manufacturers to purchase raw materials from unusual markets, in excessive quantities, with the frequent result that arrivals were badly bunched and unloading was slow and difficult; (5) the necessity for giving priority to shipments of Government freight, and the lack of central control, and (6) the withdrawal for overseas service of Atlantic coastwise vessels.

The controlling factor throughout the experience has not been in road transportation, but at the ultimate destination, and any serious condition of congestion obtaining on any of the trunk lines en route has been the reflex of the other conditions at the terminals themselves. Practically all transportation in the United States has been based primarily upon the desires and necessities of the consignor rather than upon the ability of the consignee to receive and digest the freight.

The most serious situation presented itself in the case of bituminous coal. This condition was the result of three factors: (1) Actual shortage of cars at the

mines; (2) lack of systematic distribution, and (3) dislocation of the New England supply, the result of the withdrawal of coastwise steamships.

The bituminous coal production for the preceding year had been the largest in the history of that industry, approximating 544,000,000 tons. The severe weather conditions in January, 1918, resulted in decreased production—due almost entirely to the car supply—of 65,294 carloads. Immediate and drastic steps were taken to remedy this situation, and, notwithstanding the severe weather throughout February and March, the railroads in February produced an increase of 24,366 cars of coal over the preceding February, and for the succeeding months continued to produce large increases, to a maximum of 150,288 tons in July over the preceding month of July. The net increase for ten months was 741,665 cars; or approximately 37,080,000 tons more of coal were obtained. New England necessities have been fully met, and the largest tonnage of coal ever known—28,153,317 tons—has been moved to the Lake Erie ports and transported to the Northwest, compared with 26,826,000 tons in 1917.

A very considerable proportion of the credit for the increase must be attributed to the operation of the zone plan, which overcame the cross-hauling of coal and insured its provision from the nearest accessible market. Under this plan various bituminous coal-mining districts east of the Rocky Mountains were separated, and to each was assigned a definite territory wherein it could market its coal. Coal from any district could be shipped to destinations beyond zones allotted to that district only upon permit of the Fuel Administration.

The coal-zoning plan not merely saved car-miles, but in addition permitted the utilization of coal produced in the plains states which would not otherwise have been produced.

Shortage of Foodstuffs

A program had been arranged by the Food Administration by which approximately 1,160,000 tons of food per month were to be forwarded to the Allies. Early in February it was found that only 750,000 tons had been forwarded in January, and at the same rate of progress only 500,000 would have been forwarded in February. Empty box cars were moved in preference from all sources in the East and South into the Western grain states, with the result that by Mar. 15 the vessel capacity of the allies had been satisfied and there was available at North Atlantic ports an excess on wheels of 6318 cars of foodstuffs, exclusive of grain on cars or in elevators.

To simplify and economize the methods of transportation, the following actions were taken under unified control:

Unification of terminals was made general throughout the country at both large and small stations; terminal managers have been appointed for the larger terminals, and where unnecessary mileage was not involved a consistent effort was made to route freight so as to arrive at the specific terminal where it is to be disposed of. Interchange switching in terminals has been eliminated, so far as this was practicable.

The following are typical examples of what has been done by unification:

1. The Southern Pacific, Atchison, Topeka & Santa Fé, and the Western Pacific, each maintained passenger ferry service between Oakland and San Francisco. The Santa Fé and Western Pacific passenger trains have been brought into the Oakland mole of the Southern Pacific. The latter's railroad facilities were ample for the three lines. Dispensing with the ferry service of the other two effected an approximate saving of $315,000 per annum. All railroad and marine facilities in New York harbor were consolidated under a marine manager and have been used in common. One hundred and seventeen coal-carrying barges and 18 tugs belonging to the Philadelphia & Reading, Lehigh Valley, New York, Ontario & Western, and Erie Railroads were pooled under a single management. All passenger trains of the Baltimore & Ohio and through passenger trains of the Lehigh Valley were brought into the Pennsylvania R.R. terminal in New York City.

2. Short-hauling of freight has been consistently followed, except where better grade conditions and less congestion were favorable factors on a somewhat longer line. An instance is the Northwestern region, where the correction of improper routing within a period of five months showed a saving of 4,054,455 car-miles on 34,941 carloads.

3. Solid trains for definite destinations were made up at Chicago, Minneapolis, St. Paul, St. Louis and at Missouri River crossings, resulting in a decrease in intermediate terminal switching and the expedition of essential Government freight.

4. Nonessential passenger trains have been eliminated, with the result that the number of trains discontinued resulted in a saving per year in passenger-train miles of 16,254,000 in the Eastern region, and a maximum of 23,280,000 in the Northwestern region.

5. Common use of freight cars.

6. Common use of repair shops.

7. The New York tubes were utilized for the movement of anthracite coal from New Jersey terminals to Long Island, affording substantial relief at a most critical time. Under its franchise this could not have been done by the Pennsylvania R.R. under private operation.

The enormous tonnage which is handled locally at the Pittsburgh gateway makes it very difficult to use it for trunk-line traffic. The trunk-line railroads through Pittsburgh should be relieved by the construction of an entirely new freight line connecting them east and west of Pittsburgh, but entirely avoiding the industrial area.

Condition of Equipment

The extended period of heavy business, high prices for material, difficulty in obtaining sufficient labor, loss of many experienced mechanics through the selective draft, followed by an early and unusually severe winter in 1917-18, resulted in a generally defective condition of locomotives and cars. The remedy was not so much the building of new locomotives and cars as the proper maintenance of those in service, and more prompt movement of trains. It was found that shop facilities were sufficient if efficiently used; therefore, the task of

nationalizing these facilities and assigning locomotives to shops where repairs could be made regardless of ownership was assigned to the chief inspector of the Bureau of Locomotive Inspection.

Roundhouses built 20 or more years ago were still being used to house locomotives more than twice the size of those for which they were designed. Repairs had to be made either out of doors or in open roundhouses at a temperature below zero. On the Baltimore & Ohio R.R. 133 locomotives froze up in the period from Dec. 28, 1917, to Jan. 5, 1918. In spite of these conditions, the situation immediately began to improve under the plan organized by the mechanical department of the Railroad Administration. After successful solution of certain labor difficulties, there was a noticeable increase in the production of the shops and engine houses where disputes had occurred. The average increase in locomotive-shop hours for the entire country amounted to about 16 per cent.

Standardized Locomotives

Designs were worked out for standardized locomotives, and orders for 1430 were given. These locomotives were built from standardized designs for the following reasons: To reduce to a minimum the time required to prepare drawings, patterns, and dies; to secure quantity deliveries—the increased production due to the standardized locomotives was about 50 per cent.; to provide a supply of equipment the parts of which are largely interchangeable and available for use anywhere in the event of congestion.

The freight-car situation was handled along the same lines, and after careful consideration designs were prepared and orders placed for 25,000 self-clearing steel hopper cars of 55 tons capacity, 25,000 single-sheathed box cars of 50 tons capacity, 25,000 double-sheathed box cars of 40 tons capacity, 20,000 composite gondolas of 50 tons capacity, with drop doors, and 5000 low-side gondolas of 70 tons capacity. In addition, many designs for other freight cars and steel baggage cars were made.

Instead of hauling new locomotives dead, orders were issued that wherever possible they should be moved under steam, hauling trains where practicable. This order relieved the railroads from 500,000,000 ton-miles of transportation annually for material which not only should be self-propelling, but should haul additional freight. The terminal facilities for the maintenance of locomotives and cars were consolidated at 417 points, and the annual saving effected thereby amounts to $2,363,500. Additional consolidations are under way. At one large shop the output of locomotives receiving classified repairs increased over 50%, and increases ranging from 10% to 25% were secured in many shops.

By rearranging methods of handling locomotives at terminals, it was possible to overcome what otherwise would have been a shortage in motive power. For example, on one railroad an appeal was made for an additional assignment of 25 Mallet locomotives, but by changing the method of handling at important terminals delay was reduced, and this road was able to release for service on other lines nine locomotives instead of requiring extra ones. There are now in reserve 1021 locomotives in various regions, and there are in storage 150 new standardized locomotives recently received to furnish surplus power to pass through the present winter.

In his report to the Interstate Commerce Committee of the United States Senate, Jan. 3, Mr. McAdoo included the following detailed figures on expenditures, on the elimination of circuitous routes, and on the special unification problem at Cincinnati.

The total improvements on all lines under Federal control, authorized to Dec. 1, 1918, amounted to $1,254,396,158, of which $656,058,745 was authorized for equipment. For this work expenditures had been made up to Nov. 1, 1918, of $477,211,012, of which $248,442,873 was for equipment.

The elimination of many circuitous routes in the handling of freight traffic has resulted in efficiency which cannot be measured only by the car-miles saved through diversions of freight in transit. The saving in distance by many of the new routes is great; for example, one from Los Angeles to Dallas and Fort Worth is over 500 miles shorter than that formerly used; another from the oil fields of Casper, Wyo., to Montana and Washington State points, is 880 miles shorter; fruit from southern California to Ogden is hauled 201 miles less and a new route between Kansas City and Galveston has been developed which is 289 miles shorter than the 1121 miles previously traversed by one line. The ore traffic moving from Minneapolis and Michigan mines to Lake Superior and Lake Michigan ports was rerouted. During the shipping season a total of 64,770 loaded and empty cars were rerouted with a saving of 3,577,464 car-miles.

Difficulties in Terminal Unification

A concrete illustration emphasizes the present difficulties in terminal unification: Three important railroads reach Cincinnati by crossing the Ohio River and four other important railroads reach it on the north bank of the Ohio River. The interchange of traffic between these lines at Cincinnati is enormous, and the conditions are such that in times of heavy traffic the freight at Cincinnati is badly congested. Under private management these railroads have never been able to get together and put into effect any comprehensive plan which would result in terminal facilities equal to the situation.

At the present time there are perhaps 25 or 30 freight houses in and around Cincinnati which have been provided primarily for the particular use of the separate railroad companies. It is estimated that there ought to be spent in the near future about $45,000,000 in the rehabilitation of Cincinnati terminals so as to make them equal to modern public needs, with probably $25,000,000 additional for passenger terminals. This involves the building of a new bridge and the reconstruction and enlargement of two other bridges, the construction of convenient and commodious freight houses, the provision of adequate belt lines and adequate facilities for intercommunication between the various railroads.

By the establishement of a permit system whereby traffic is not allowed to be loaded except upon showing that it can be delivered to the consignee at destination, there was effected practically a complete absence of congestion during the autumn months of 1918 when traffic was at its heaviest.

Find Cause of Obnoxious Tastes in Milwaukee Water

Coal Tar Derivatives from Coke and Phenol Plants Produce Taste When Diluted One Part in 500 Million

By H. P. Bohmann
Superintendent, Milwaukee Water-Works

For a number of years, but particularly during the present year, the water-supply of Milwaukee has been under discussion, owing to the obnoxious taste and odor present at times, and frequently referred to as a "medicinal taste" or a taste similar to that of iodoform or carbolic acid. During 1918 the taste and odor were so nauseating at times as to make the water absolutely unfit for drinking and cooking purposes, as the taste remained in the water even after boiling. In fact, the taste seemed more pronounced after the water was boiled. At first these odors and tastes were attributed to the use of chlorine in disinfecting our water-supply, and whenever the taste appeared the quantity of chlorine was reduced, although it was soon discovered that the taste frequently appeared when smaller quantities of chlorine were used, and was absent when larger quantities were being applied. It was also discovered that these objectionable tastes and odors were always accompanied by south or southwest winds, which blow the contaminated water from the harbor outlet, where the three rivers which flow through the city unite and discharge their sewage-laden contents into the lake, towards the water intake, which is only 3½ miles from the harbor outlet, in a northeasterly direction.

As the chlorine treatment is carefully supervised by a competent chemist, and the tastes and odors occurred only when the wind was from a certain direction, we were convinced that they were not due to the use of chlorine alone, but that the action of the chlorine on some of the organic matter present in the polluted lake water formed compounds that produced taste and odor. That chlorine in the quantities used (0.22 to 0.34 ppm.) did not produce the tastes and odors was also apparent from the fact that taste and odor were present on days when the free chlorine in the tap water in various parts of the city was low, and absent on other days when the free chlorine was 50% greater, although the quantity of chlorine applied was the same on both dates. Furthermore, the water of South Milwaukee, with a filtered supply, and using one-half the quantity of chlorine applied at Milwaukee, had the same obnoxious taste when wind conditions were favorable.

Suggestion at Water-Works Convention

In discussing the matter of tastes in water-supplies with a member of the American Water-Works Association in 1917 I learned that he had experienced trouble similar to ours, and that he attributed it to the industrial waste, from a coke plant, which was getting into his water-supply. With this information as a key to a possible solution of our troubles, samples were taken of the effluents being discharged at the local coke and gas plants. In the water-works laboratory chlorine was added to a sample of tasteless raw water until the ortho-tolidin test showed 0.09 ppm. of free chlorine in the sample, this amount of free chlorine representing the maximum that the tap water has ever contained. The addition of chlorine did not produce any taste in the sample. After the addition of some of the effluent from the coke plant to the chlorinated sample, the sample had a decided taste, resembling that of coal-tar derivatives, and was almost identical with the characteristic taste at times present in our water-supply. The sample was then boiled and cooled to its former temperature. The ortho-tolidin test then showed no free chlorine present, while the taste was stronger than before the boiling.

The results of the initial test of the first three samples pointed to coal-tar derivative wastes in combination with the chlorine added to our water-supply. These substitutive or additive compounds are probably the direct cause of the taste in the water. Such compounds boil at a higher temperature than water, and, therefore, would not be expelled in boiling.

Joint Investigation Made

At this point in the experimental work, all further investigations of the cause of the taste in the city water were carried on jointly by Robert L. Piper, chemist of the water-works, and Russell W. Cunliffe, chemist of the Health Department. Nearly 900 samples of sewage and trade waste were obtained and tested for taste in the manner above described, since, when greatly diluted in the lake, it is impossible to prove the presence of these substances by any chemical determination. These samples represented trade waste effluents and sewage of every description, such as those from hospitals, tanneries, packing houses, glue works, and from intercepting sewers carrying sewage from metal works, breweries, homes, etc.; also from gas plants, coke plants, and chemical industries manufacturing coal-tar products.

The results of the tests clearly indicated that the tastes and odors complained of in the water supply of Milwaukee are due to coal-tar derivative wastes from industrial plants, in combination with the chlorine used by the city for the purification of its drinking-water supply. It is only from samples of effluents of a coal-tar derivative nature that the characteristic and obnoxious taste present at times in our water-supply could be reproduced in the laboratory. All other samples failed to produce this taste. It was possible to add sufficient chlorine to a sample of tasteless raw water to produce a chlorine taste, which, however, is quite different from the taste complained of. This chlorine taste could, in every instance, be removed by boiling, or neutralized by sodium thiosulphate. The objectionable taste complained of in the water, however, could not be removed by either of these two methods. Furthermore, tests on solutions of tasteless raw lake water and various substances, such as naphthalene, benzol, phenol, petroleum oil, etc., demonstrated that upon chlorination only do these solutions which contain substances of coal-tar derivation produce tastes; in other words, only those substances which are or may be present in the taste-producing effluents mentioned above. There are, undoubtedly, substances of coal-tar derivation other than those mentioned which, when combined with chlorine, would form taste-producing bodies.

A survey made of all industrial plants whose industrial wastes contained objectionable elements of coal-tar derivation indicated that in addition to the local coke and gas plants there were five plants located outside of the city whose effluent might possibly contribute to our water pollution. Of these, three were at Carrollville, which is about 8 miles south of our southern city limits, and about 13 miles distant from our water intake. These plants were under suspicion from the start as contributors to our trouble, although it was impossible for a long time to establish this fact, owing to the difficulty of obtaining samples out in the lake when wind conditions were favorable. However, at a later trip, the fact was established beyond doubt, as samples were obtained at various points in the lake between the water intake and Carrollville, which upon chlorination produced the objectionable taste in varying degrees.

One of the three plants at Carrollville was engaged in the production of phenol for the United States Government, partly in its own plant and partly in a building owned by the Government. The combined production of phenol in the two plants, which originally amounted to only a few tons a day, had greatly increased until, during October, 1918, it amounted to 130 tons daily. It was estimated by the management that the daily trade waste flowing into the lake contained anywhere from 1100 to 2200 lb. of phenol, and the management was inclined to believe that the latter figure was more nearly correct. The possibilities of producing taste in a water-supply can best be appreciated when we learn that taste can be produced, after chlorination, in solutions containing one part of phenol to 500,000,000 parts of water. This amount of phenol could pollute from 60,000,000,000 to 120,000,000,000 gal. of water to such an extent that taste could be produced upon chlorination.

Appeal Made to State and Federal Authorities

When the obnoxious taste again appeared in a very acute form, early in November, an appeal was made to the State Board of Health to assist the local officials in obtaining immediate measures of relief. Telegrams were sent by Mayor D. W. Hoan to Dr. Rupert Blue, surgeon general, United States Public Health Service, and Newton D. Baker, secretary of war, asking them to lend their assistance, as it was asserted that some of the companies were engaged in Government work. A meeting was held in the mayor's office, which was attended by Governor Philipp, city and state officials and representatives of the coke and gas companies. After a general discussion of the subject, Governor Philipp suggested that the mayor appoint a committee to study the report made by the chemists, visit all of the plants under suspicion and, if possible, place the responsibility for the obnoxious taste. The mayor then made the following appointments: Dr. C. A. Harper, state health officer, and Prof. J. C. D. Mack, state chief engineer, representing the state; Dr. George C. Ruhland, health commissioner, H. P. Bohmann, superintendent of water-works, and William R. Copeland, chief chemist of the Sewerage Commission, representing the City of Milwaukee; R. B. Brown, general manager and chief engineer of the Milwaukee Gas Light Co.; J. W. Shaffer, vice-president in charge of operation of the Milwaukee Coke and Gas Co., the Newport Hydro-Carbon Co. and the Newport Chemical Works, Inc., representing the industrial plants.

The committee visited the various plants, and testimony was taken at each plant by Dr. C. A. Harper, state health officer. Later a meeting of the committee was held at Madison, at which the committee framed its formal report. The conclusions were:

Carbolic-Acid Plant Wastes

"That, from its personal investigation and from a careful study of the reports that have been worked out by the chemists of the water department, the health department and industrial companies, the obnoxious odor and taste complained of in the Milwaukee water-supply are essentially attributable to the effluent coming from the Newport Hydro-Carbon Co., a plant engaged in the manufacture of carbolic acid. It finds its belief substantiated in the fact that from Nov. 26 to Nov. 29, during southerly winds, when operations of the plant were suspended, there was no recurrence of the nuisance in the city's drinking water."

Since the latter date the plant of the Newport Hydro-Carbon Co. has been permanently closed, and no more phenol will be produced there. This will undoubtedly remove the largest factor in our water trouble.

The next largest contributor was the coke company, where it was estimated that about 91 lb. of phenol was discharged daily with its industrial waste. It was estimated that the amount of trade waste having taste-producing properties leaving the coke plant daily was sufficient to impart taste, of the kind complained of in our water-supply, to 10,000,000,000 to 40,000,000,000 gal. of water. The other plants contribute to this pollution according to the volume of the effluents discharged from their respective plants, all of them, however, to a far less degree. The taste-producing properties of the effluents of the plants investigated were found to range from dilutions of 1 to 100 to 1 to 400,000.

Basing opinion on the results of the many tests made, it is reasonable to assume that any water-supply which is being chlorinated, and which occasionally has a medicinal or phenol-like taste which cannot be removed by boiling, may have been contaminated with waste material produced in the destructive distillation of coal and in the recovery and manufacture of the byproducts of this process; otherwise, it should be possible to remove the taste by boiling. The only practical method known at the present time to avoid taste of this nature is to keep this particular kind of effluent out of a water-supply. No water-supply which is polluted with coal-tar derivatives and where chlorine is used as a sterilizing agent can be made palatable for drinking purposes. It is possible that by laboratory experiments some chemical may be found which will overcome the affinity of chlorine for the coal-tar bodies or change their composition so that they will not unite with chlorine. Every effort is being made by the coke and gas companies to find a method of taking care of their wastes.

Undoubtedly, some of the readers of *Engineering News-Record* know that the City of Milwaukee has planned an extensive program for improving its water-supply. With that program carried out Milwaukee can be assured of the best of water-supplies.

Light and Heavy Equipment Compared on Identical Sewer Construction

Field Costs per Unit of Sewer Are Substantially the Same for Both Plants—Greater Speed Possible with Heavier Plant, According to Results Obtained

By Ralph H. Burke
Division Engineer in charge of Sewer Work, Sanitary District of Chicago

DIRECT comparison of efficiency of heavy and of light equipment in nearly identical operations is afforded by the construction of the Calumet intercepting sewer for the Sanitary District of Chicago. Field construction costs per unit of completed sewer, based on the working conditions prevailing during four months in 1917 and using figures which do not apply to the whole work on either contract, averaged about the same for both sizes of plant. Speed of construction, however, was about 65% greater with the heavier equipment. It also required a 25% larger working force and cost about 17% more per day to operate than did the lighter outfit.

The preceding figures do not include the installation of equipment, special work at curves or crossings, or other items peculiar to the individual contract section. Also, they cover only the operations in the field, and do not include general expenses such as overhead, insurance, bonding and general administration charges. It should be repeated that the figures are comparative only, and do not represent the total costs for all work on either section.

The Calumet intercepting sewer extends from South Chicago to the Calumet-Sag Channel near Blue Island, a distance of about nine miles. The total cost of the project is approximately $3,600,000. The sewer section is concrete, of horseshoe shape, with a rather flat invert and a semi-circular crown, and varies in size from 11 ft. to 17½ ft. internal width. The cuts are comparatively shallow on the easterly three miles, ranging from 14 to 18 ft., while on the westerly six miles the cut is about 30 ft. The material encountered consists of sand and sandy clay in the shallow cut, and chiefly clay, varying from soft to very hard, in the deep cut. The work is located largely through sparsely settled territory, where ample room is available for the operation of the plant. The construction has required the use of plant not ordinarily employed on sewer work in the vicinity of Chicago. The excessive width and depth of the cut preclude vertical trenching. The cost of timbering to support a steam shovel or other excavating plant capable of handling work of this size would be prohibitive. On the shallow cut, dragline excavators were employed for the entire excavation, while on the deep cut the work has been divided into two lifts, the upper lift being excavated by a steam shovel, the lower lift by a dragline moving along the bottom of the shovel cut. This method requires the sloping of the sides of the top cut not only to avoid continuous bracing, but also to allow sufficient width for the operation of the dragline. That portion of the cut below the haunches of the sewer section is vertical, as nearly as possible, and, in general, the concrete is placed against the earth without the use of back forms. The typical sections illustrated indicate the general proportions and dimensions of the work.

TABLE I. CONSTRUCTION PLANTS ON SECTIONS 4 AND 7, CALUMET INTERCEPTING SEWER

(Four Months during 1917)

Section 4	Section 7
Excavating Plant	
1. Thew revolving steam shovel, size 0; 1-cu.yd. bucket.	1. Marion standard steam shovel, model 76; 40-ft. boom, 40-ft. dipper-handle, 2½-cu.yd. bucket.
2. Lidgerwood dragline; 70-ft. boom; 2-cu.yd. Page bucket.	2. Bucyrus dragline, class 14; 65-ft. boom; 2½-cu.yd. Page bucket.
3. Fifteen 1½-cu.yd. dump wagons; 16 wooden, side-dump, 4-cu.yd. cars; 1 mile 36-in. gage track, 45-lb. rails; two 14-ton Davenport locomotives.	3. Thirty-six 6-cu.yd. Western dump cars, automatic couplers; two miles standard-gage track, 60-lb. rails; four 25-ton Vulcan locomotives.
Backfilling Plant	
Timber revolving derrick with ¾-cu.yd. orange-peel bucket.	Western Wheeled Scraper Co. standard-gage spreader.
Concrete Plant	
Overhead 400-cu.yd. bins; 2000-bbl. cement house; derrick car with ¾-cu.yd. clamshell; 75 Koppel 27-ft. steel dump cars; 2 Chain Belt mixers, 1-cu.yd.; 150 lin.ft. collapsible Blaw steel forms with traveler; 1 mile 20-in. gage track, 25-lb. rail.	Overhead 600-cu.yd. bins; 2500-bbl. cement house; Brown Hoist 15-ton locomotive crane with 1½-cu.yd. clamshell bucket; 30 Easton steel dump cars 40 cu.ft., three 8-ton Vulcan locomotives; 2 Foote 40-cu.ft. mixers; 175 lin.ft. collapsible Blaw steel forms with traveler equipped with 6-hp. Fairbanks-Morse gasoline engine for moving; 2 miles 36-in. gage track, 50-lb. rail.

The work was divided into contract sections, each with a length of about a mile and a half. The plant employed is quite similar in character on all sections, but differs in details and as to the sizes of the main units. A direct comparison can, however, be made between large and small plant units, both similar in type, and both employed on work of equal magnitude. This opportunity is exceptional, since each construction job

CONSTRUCTION PLANT ON SECTION 7 DISTINGUISHED BY HEAVY EQUIPMENT UNITS

usually presents problems peculiar to itself, requiring certain adaptations of ordinary contractor's equipment not called for on other work. Also, the results obtained in each case ordinarily cannot be applied to other work without allowances for the different requirements. On the Calumet sewer, however, the work under the separate contracts is almost identical in magnitude and as regards working conditions; the plant employed is similar in character and operation, and a comparison of results can be made without the usual introduction of inexact and unknown factors which so vitally affect costs.

Sec. No. 4 and Sec. No. 7 of the Calumet intercepting sewer were built, respectively, by Nash Bros. and by the T. J. Forschner Contracting Co., both of Chicago. Both contract sections have been handled very efficiently, and the finished work in both cases is of the highest grade in every respect. The cut in both cases was about 30 ft. The sewer section has an internal width of 16½ ft. on Sec. 4 and 16 ft. on Sec. 7.

Excavation in both cases was performed in two lifts; the top lift, about 10 ft. in depth, was handled on Sec. 4 by a small revolving steam shovel, loading dump wagons, while on Sec. 7 a large standard steam shovel was used, loading standard-gage dump cars. The bottom lift on both sections was handled by a medium-sized dragline excavator. On Sec. 4 the earth was piled on one side of the cut and was also loaded into narrow-gage 4-cu.yd. dump cars, while on Sec. 7 it was loaded into standard-gage 6-cu.yd. dump cars.

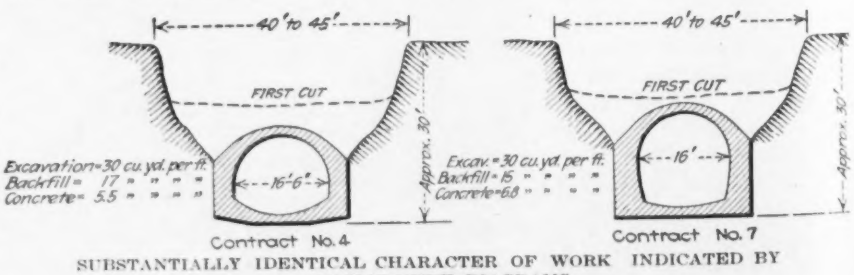
Backfilling was done with the earth excavated from the bottom cut. On some parts of Sec. 4 the earth stored along the side of the cut was placed in backfill by a revolving derrick equipped with an orange-peel bucket, while on other parts of the work the earth was hauled directly to backfill in dump cars and spread by hand. On Sec. 7 the dump cars transported the excavated material directly to backfill, grading being accomplished by a standard-gage spreader.

The concrete was placed on both sections by two batch mixers moving along one side of the cut. Crushed stone and sand were unloaded from the railroad cars and placed in overhead bins, a derrick-car equipped with clamshell bucket being employed on Sec. 4, while a locomotive crane with clamshell bucket was used on Sec. 7. The batches were proportioned at the bins by filling small steel dump cars with sand, stone and cement, each carload forming a batch of concrete. The cars passed under the bins and were filled by gates with the exact batch amount of sand and stone. The cement was charged by tipping buckets, each holding cement for one batch. The cars on Sec. 4 held 27 cu.ft. and operated on a 20-in. gage track, being hauled in trains of nine cars by means of horses. On Sec. 7 the cars held 40 cu.ft. and operated on a 36-in.-gage track, being hauled in trains of 12 cars by means of dinkey engines. From July to October, 1917, work on both sections progressed without interruption and without special features peculiar to either. Costs and output of the two plants during this period are therefore strictly comparable.

TABLE II. CONSTRUCTION ORGANIZATION ON SECTIONS 4 AND 7 CALUMET INTERCEPTING SEWER

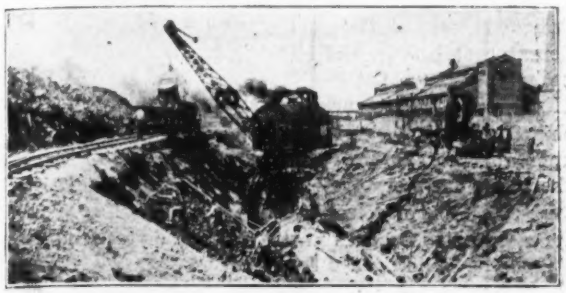
(Four Months during 1917)

Section 4	Section 7
General	
1 Superintendent	1 Superintendent
1 General foreman	1 General foreman
1 Timekeeper	1 Timekeeper
1 Material man	1 Blacksmith
1 Pumpman	1 Blacksmith helper
2 Watchmen	1 Pumpman
1 Waterboy	2 Watchmen
8 Total	8 Total
Excavation:	
Steam Shovel Crew	
1 Engineer	1 Engineer
1 Fireman	1 Craneman
1 Pitman	1 Fireman
	4 Pitmen
	1 Coal passer
	1 Laborer
3 Total	9 Total
Dragline Crew	
1 Engineer	1 Engineer
1 Fireman	1 Fireman
2 Bottom men	4 Bottom men
2 Ground men	2 Ground men
	1 Coal passer
	1 Laborer
6 Total	10 Total
Waste Disposal	
1 Foreman	1 Foreman
12 Teams and drivers	2 Dinkey engineers
	2 Switchmen
	12 Laborers
13 Total	17 Total
Backfilling:	**Derrick Crew**
1 Engineer	1 Foreman
1 Fireman	2 Dinkey engineers
2 Groundmen	2 Switchmen
4 Laborers	6 Laborers
8 Total	
	Train Crew
1 Dinkey engineer	
1 Switchman	
8 Laborers	
10 Total	21 Total
Concrete Work:	**Unloading Materials**
1 Crane Engineer	1 Crane engineer
1 Fireman	1 Fireman
2 Laborers	2 Laborers
4 Total	4 Total
	Transportation of Materials
5 Horses and drivers	2 Dinkey engineers
2 Laborers on bins	2 Switchmen
5 Laborers on cement	3 Laborers on bins
3 Laborers on cars	5 Laborers on cement
	3 Laborers on cars
15 Total	15 Total
	Mixing and Placing
1 Foreman	1 Mixer engineer
1 Mixer engineer	1 Mixer helper
4 Concrete men	4 Concrete men
	1 Cement finisher
6 Total	7 Total
	Forms
4 Form movers	1 Foreman
1 Carpenter	4 Form movers
1 Carpenter helper	3 Carpenters
	2 Carpenter helpers
6 Total	10 Total
Grand total, 80 men	Grand total, 100 men



SUBSTANTIALLY IDENTICAL CHARACTER OF WORK INDICATED BY COMPARATIVE DIAGRAMS

The average progress per working day was 25 lin.ft. of completed sewer on Sec. 4 and 41 lin.ft. on Sec. 7. The average force employed was 80 men on Sec. 4 and 100 men on Sec. 7. Labor costs averaged about $382 per day on Sec. 4 as compared with $407 per day on Sec. 7. Plant costs amounted to $135 per day on Sec. 4 and $200 per day on Sec. 7. The plant costs include all those of operation, such as coal, oil and other supplies, and include also an allowance for interest, maintenance and depreciation averaging about 5% per month on the value of the plant.



NARROW-GAGE TRACK AND LIGHT EQUIPMENT EMPLOYED ON SECTION 4

Summarizing and charging all costs against the two main items, excavation and concrete, the unit costs are as follows:

Item:	Sec. 4	Sec. 7
Excavation, per cubic yard	$0.40	$0.28
Concrete, per cubic yard	5.91	5.27

The quantities upon which these figures are based are the actual quantities, as shown by the accompanying typical cross-sections.

Based on the linear feet of completed sewer, the cost is $44.50 per foot on Sec. 4 and $44.15 per foot on Sec. 7.

Comparison of the items which make up the preceding totals is presented in the three accompanying tabulations.

The construction of the Calumet intercepting sewer is under the direction of the engineering department of the Sanitary District of Chicago, of which G. M. Wisner is chief engineer and the writer is division engineer, in charge of sewer work.

TABLE III. UNIT COSTS ON SECTIONS 4 AND 7, CALUMET INTERCEPTING SEWER

(Four Months during 1917)

Section 4		Section 7	
Quantities per Foot of Sewer			
Excavation, cu.yd.	30	Excavation, cu.yd.	30
Concrete, cu.yd.	5.5	Concrete, cu.yd.	6.8
Quantities per Working Day			
Excavation, cu.yd.	750	Excavation, cu.yd.	1,230
Concrete, cu.yd.	138	Concrete, cu.yd.	279
Completed sewer, lin.ft.	25	Completed sewer, lin.ft.	41
Unit Costs			
Excavation	Cu.Yd.	Excavation	Cu.Yd.
Labor	$0.31	Labor	$0.20
Plant	.09	Plant	.08
Total	$0.40	Total	$0.28
Concrete			
Labor	$1.11	Labor	$0.58
Plant	.47	Plant	.36
Total	$1.58	Total	$0.94
Materials	4.33	Materials	4.33
Total	$5.91	Total	$5.27
Completed Sewer			
	Lin.Ft.		Lin.Ft.
Labor	$15.28	Labor	$9.93
Plant	5.40	Plant	4.78
Materials	23.82	Materials	29.44
Total	$44.50	Total	$44.15

Accidents on Railroads Reported by Interstate Commerce Commission

DURING the year which ended June 30, 1918, there were 91 train accidents investigated by the Interstate Commerce Commission, according to the latest annual report. In these accidents, comprising 63 collisions and 28 derailments, 374 persons were killed and 1730 were injured; 26 collisions occurred on block-signal lines, 13 in automatic block-signal territory, and 13 in nonautomatic block-signal territory, five occurred on track where yard rules were in effect, and 31 occurred on lines operated by the train-order and time-interval system.

Of the 13 collisions which occurred in automatic block-signal territory, eight were due to failure of enginemen to heed automatic indications, and one was caused by failure of the train crew to obey a rule; in the other four cases, the signal system in use was not involved, two of these being due to trains running away on mountain grades and two involving trains running against the current of traffic, which movements were governed by train orders.

The most disastrous accident during the year resulted in the deaths of 60 persons and the injury of 128, and occurred on a line operated by a modern automatic block-signal system; it was caused by an engineman falling asleep and failing to see a stop signal. Since accident investigations were begun by the Interstate Commerce Commission in 1911 approximately 10 per cent. of the total number investigated were caused primarily by the disregard of signal indications. As many of these accidents occurred on lines equipped with the best signal systems, properly installed and maintained, the urgent need of some further safeguards, such as automatic devices designed to compel obedience to signal indications, is apparent.

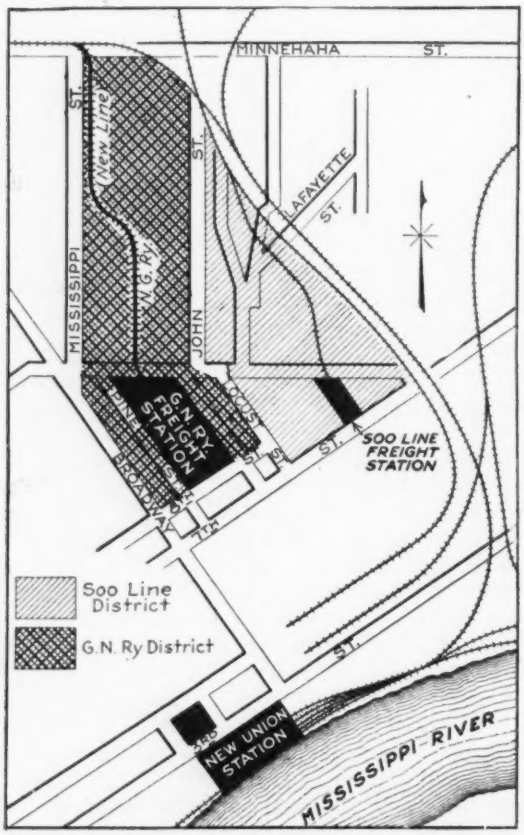
Approximately half of the collisions investigated during the year occurred on lines operated by the train-order and time-interval system; many of them were due to the inherent weaknesses of that system. Nine were due to errors in issuing, transmitting, or observing train orders; seven were caused by a train occupying the main track on the time of superior trains without proper protection; and seven others were caused by failure of flagmen to protect their trains properly; four were caused by failure of enginemen to obey prescribed speed restrictions, and four were due to purely local conditions and causes. It is stated that many of the collisions investigated during the year could have been prevented by the proper application of the block-signal principles, and it is beyond question that the adoption of the block system on lines now operated by the train-order system would result in a material reduction in the annual casualty record.

Of the 28 derailments investigated, 17 were caused by defective track and three were due to defective equipment; in three other cases the speed of trains was the primary cause, and in three cases the derailments occurred on account of local conditions.

Railways Form Industrial District At St. Paul

Over One Hundred Acres Used for Manufacturing and Freight Terminals Being Developed Near New Station

ESTABLISHMENT of an industrial district of about 117 acres at St. Paul, Minn., containing also the freight terminals of two railways, has been effected in connection with the new freight station of the Great Northern Ry., adjacent to similar facilities already provided by the Minneapolis, St. Paul & Sault St. Marie Ry. This is an important part of the improvement resulting from the construction of the new union pas-



NEW INDUSTRIAL AND TERMINAL DISTRICT IS ESTABLISHED AT ST. PAUL, MINN.

senger station. The area taken for this station included the freight terminal of the Great Northern Ry., and it became necessary to obtain a new location for the latter.

Advantage was taken of this opportunity to establish an industrial district tributary to the new freight terminal. For this purpose the railway company acquired possession of the 85-acre oblong tract shown by the heavily shaded area on the accompanying map. The area lightly shaded is that of the other railway mentioned. All the buildings in this new territory have been or will be torn down, and the ground will be used for warehouses, manufacturing plants and trackage. No definite layout for the district has been adopted as yet. The upper or narrower portion, lying between Mississippi St. and the tracks, is high ground, rising to an elevation of about 90 ft. above the graded site. The material to be excavated is mainly gravel and clay, and will be used in 1919 as filling for the elevation of tracks leading to the new union passenger station.

Both inbound and outbound freight will be handled at the new terminal. The freight house, however, is essentially an inbound house, as about 80 per cent. of the outbound freight is handled on the team tracks. This freight is loaded into jumbo cars 60 ft. long, having two doors on each side, and is taken to Hamline Transfer, midway between the business centers of St. Paul and Minneapolis, where carloads are made up for the same shipping points. For handling the inbound freight and approximately 20 per cent. of the outbound freight, there is a one-story freight house 60 x 803 ft., with its long side fronting on Pine St. A 10-ft. transfer platform, 740 ft. long, lies parallel with this, and between it and the building are four stub tracks spaced 13 ft. on centers.

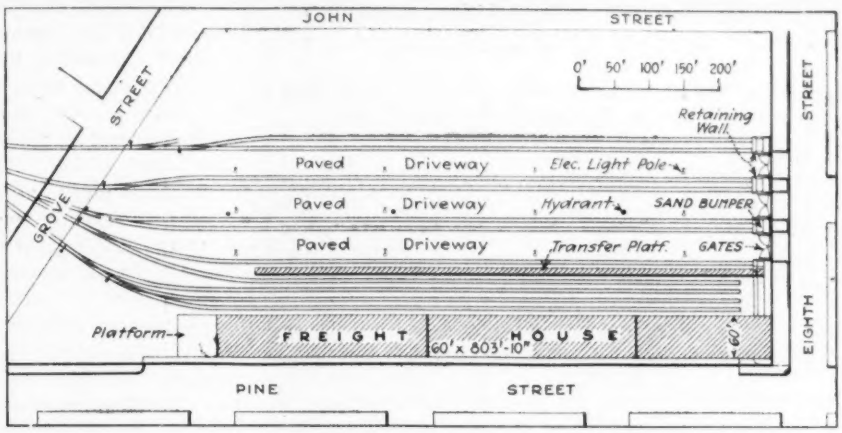
Beyond the transfer platform is the team yard, with seven tracks and three driveways, while beyond these there is room for additional trackage. Concrete curbs are placed along the driveways from which the brick-paved surface slopes down to form a central gutter, with catchbasins and sewer connections. Sand bumpers form effective stops at the ends of the team tracks. These are fills about 4 ft. deep, confined between retaining walls at the sides of the driveways. Lighting of the team yard is provided by 500-watt lamps on arms carried by 35-ft. poles, spaced 215 ft. along the driveways, the lamps being about 22 ft. above the pavement.

Brick walls and timber roof construction are used for the freight house. Its track side is entirely open, except for steel columns spaced 18 ft. 11 in. on centers and carrying a continuous reinforced-concrete lintel. The openings are fitted with steel doors which roll up behind the lintel. On the team, or street, side are 8-ft. doorways spaced 20 ft. on centers. These are fitted with steel doors which swing up on the inside but are so hung as to require a minimum of clearance space for their movements. Two firewalls divide the main floor into three sections. Owing to snow troubles, no outside platform is used on either side of the freight house. (See illustration, next page.)

A basement 300 ft. long includes a refrigerator room and a boiler room, and coal and oil storage and warehouse space, this last being served by two elevators. The basement is of concrete, with walls and columns supporting beams and girders which carry a 6-in. concrete deck slab designed for 500-lb. live load and 100-lb. dead load. Creosoted block paving 2½ in. thick covers the entire floor of the freight house. To facilitate trucking the floor has a slope of ¼ in. to the foot from the track side to the team side. The roof has plank sheathing, with tar and gravel covering, and is designed for 40-lb. live load and 20-lb. dead load. Timber construction is used for the transfer platform. Its roof is supported by side posts or bents with 20-ft. spacing, so that there is very little obstruction to movements of trucking.

A two-story section at one end of the freight house

has the cashier's office on the first floor, convenient for pub lic use. Above this are the general offices with separate locker, lunch and toilet rooms for men and women. On this floor also are a lunch room and a toilet room, with shower baths, for the freight house force, these latter accommodations being accessible directly from the main floor. Good street accommodation, permitting teams to stand at the station without interfering with traffic, is provided by paving Pine St. for a width of 63 ft. along the entire front of the freight house. The city paid for 40 ft. of roadway proper and the railroad paid for the 13-ft. boulevard or parkway and for a 10-ft. additional strip between the building and the property line. Brick paving is used, with a uniform slope from the freight house to the center of the 40-ft. roadway, beyond which the remaining 20 ft. of width has a parabolic section with a drop of 6 in. from the crown to the curb.

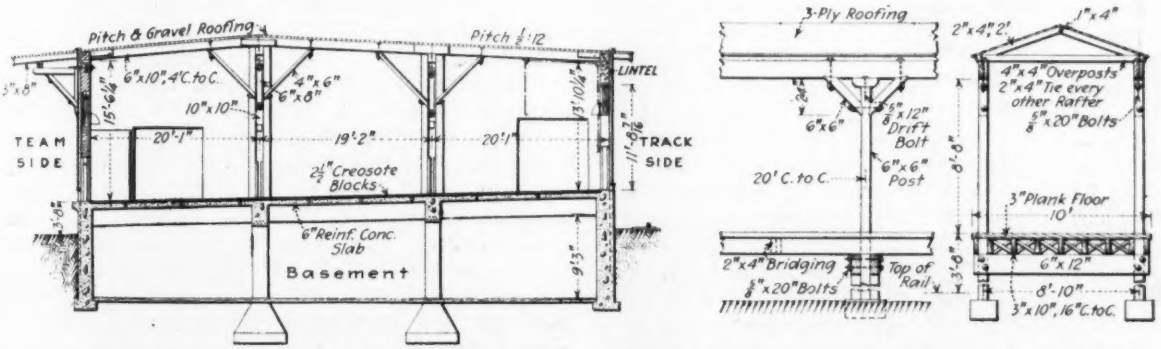


FREIGHT TERMINAL OF THE GREAT NORTHERN RAILWAY AT ST. PAUL IS MAINLY FOR INBOUND FREIGHT

Adjacent to the 85-acre industrial district noted above is a similar district of about 32 acres, being developed by the Minneapolis, St. Paul & Sault Ste. Marie Ry. This includes the railway's freight terminal, built a few years ago. This gives a total of 117 acres in one area for industrial and manufacturing purposes and railway terminals.

The street layout has been improved materially in connection with this Great Northern development. Several streets and alleys in the terminal site were vacated and other streets widened or extended to improve the traffic facilities, while 14th St. is to be extended through to Lafayette Ave. A street-car line which crossed the station site has been rerouted. John St. is widened from a 30-ft. lane to a 60-ft. street, and Locust St., Eighth St. and Lafayette Ave. are to be widened 14 ft., making them 80-ft. thoroughfares. This gives wide streets along the entrance to the team tracks and the freight-house driveway, and provides for the additional traffic which will use Lafayette Ave., this being an arterial street to the northeastern part of the city.

Making compensation for public property taken is included in the negotiations. This new industrial district replaces an old residential district, and its clearing required the abandonment of three churches, a parochial school, three public schools and a city fire station. The school department has been compensated by the Great Northern Ry. by the payment into the city treasury of $125,000 in cash and by the giving of a deed to a new site for one of the schools. The company has also purchased a site for the fire station, and will erect a new building according to plans prepared by the city architect and approved by the railway company. The latter will pay $10,000 in addition.



ROLLING DOORS FORM ONE SIDE OF FREIGHT HOUSE—TRANSFER PLATFORM HAS UNOBSTRUCTED TRUCKING AREA

To carry out this development the Great Northern Terminal Co. was organized, its chief engineer being A. H. Hogeland, chief engineer of the Great Northern Ry. H. F. Hamilton, resident engineer of the railway, is in charge of the work. T. D. McMahon, architect for the railway, drew the station plans. W. L. Johnson is contractor for the freight station and also had the contract for clearing the district. This latter was a labor contract and covered selling the houses, wrecking and selling material and clearing up the site, at cost plus ten per cent. Fielding & Shepley were the contractors for the paving. The new freight terminal represents an expenditure of $290,000, while the paving of Pine St. by the city cost $38,000.

Detail-Drawing Method Used For 8800-Ton Steel Ships

Adapted Successfully to Old-Style Ships of Fully Curved Shape—Permits Checking Pieces Before They Leave Shop

BECAUSE a civil engineer does not take naturally to pre-war shipbuilding methods of shaping a wooden templet by the cut-and-try process and then using it as a pattern, the Northwest Steel Co. at Portland, Ore., undertook to develop a better system. Even before the Hog Island plans for structural detailing had been decided upon, the scheme was under consideration at Portland, but, unlike those at Hog Island, the Portland contracts were for the old-style boats with sheer, tumble-home and camber, so that the curved surfaces complicated detail drawings considerably. The plan has worked out well, however, and boats are now being built in part from blueprints instead of by the old method of obtaining the information from the mold-loft floor lines. Only about 70% of the details have been completed, but as soon as the remainder have been worked out the blueprint plan will be used practically to the exclusion of the old method.

About 1400 drawings will be required for the complete set of details. Once these are finished, it is believed, changes which may be required from time to time can be effected to advantage, because studies of adjacent parts can be made before the change is decided upon. Advantages of this kind have already been realized in the economies that became apparent as the details were studied on the drawings with respect to one another. For example, unnecessary three-ply riveting here and there was eliminated as soon as the drawings were compared, although the advantage of this saving had never been so apparent before the drawings were used. The number of different-sized rivets in a single plate has been reduced, and minor details have frequently been simplified, without decreasing strength.

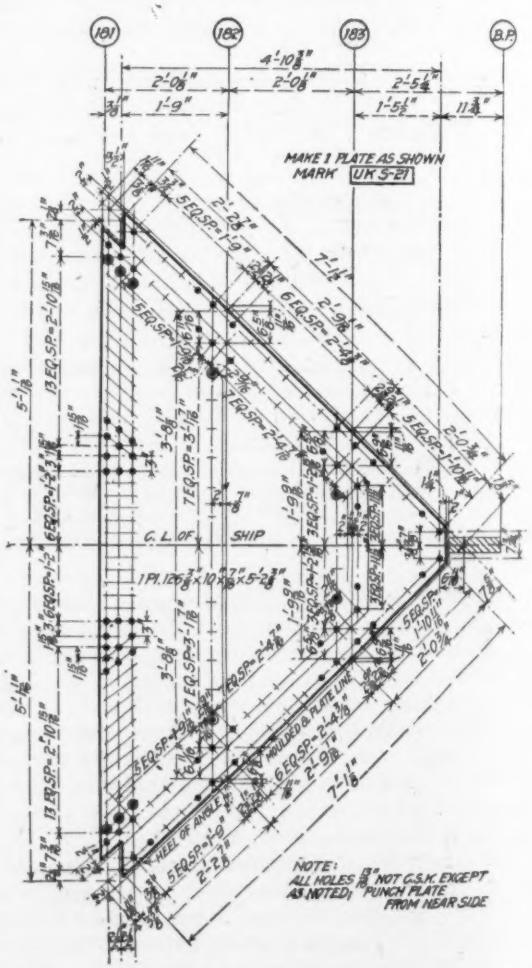
The shop-bill method of ordering shopwork, such as is usual in structural-steel practice, has been introduced in connection with the plan of using detailed drawings. Each shape or plate on which shopwork is required is now listed on a shop bill. These constitute a complete list of material for each ship and afford a means of itemizing material going through the shop and time on each separate job. This plan is commended as a means of avoiding delay and confusion as well as an aid in tracing missing material.

An important change in design was the substitution of a new type of girder. Instead of the built-up girder section, this yard is now making its girders from Bethlehem H12 column sections, with joints on pillars. This saves considerable punching, besides the time and labor required in fabrication.

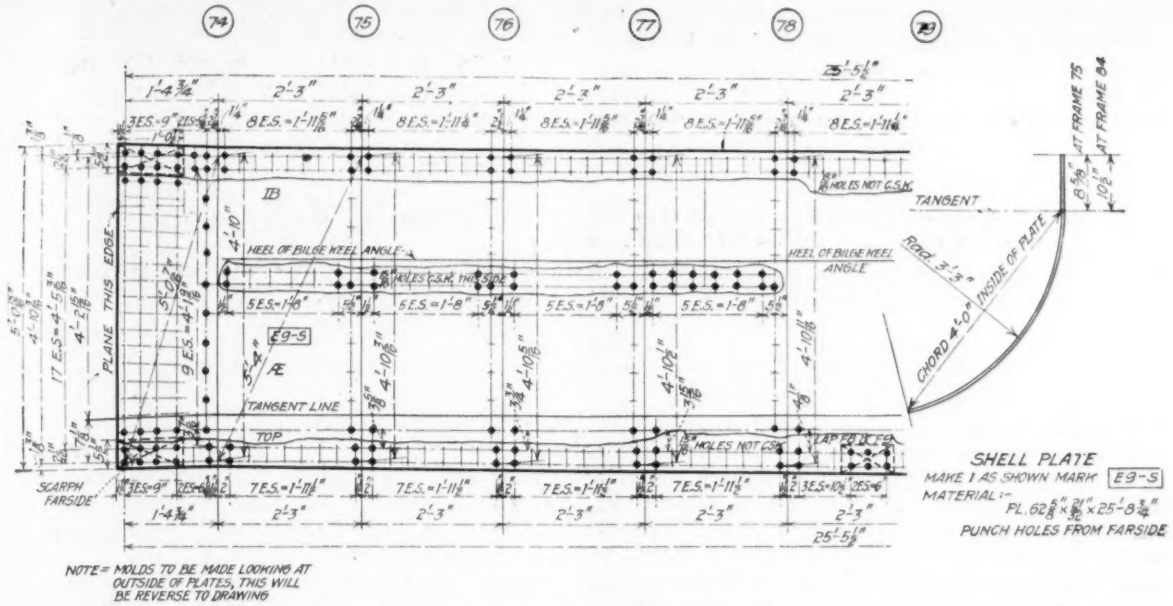
Pre-fabrication is carried out only as far as it can be done conveniently in the shop. No attempt is made to assemble in the yard, where large sections or bulkheads could be laid out. With the blueprint system, it is unnecessary to make special effort on this score, for the foreman can direct the work of assembly in the ship according to drawing. With the old system, only the shipfitter could direct the work, he being the man in whose head the layout was kept clear and from whom detailed instructions were transmitted only orally. With a system where every detail is a matter of record, notable time economies have been made and a structural-steel crew can be very quickly adapted to do this work effectively.

Although large sections are not fabricated in an assembly yard, it is the custom to make up assembled drawings just as is the case with large steel structures. These sectional drawings are issued for the guidance of inspectors and foremen, and are constantly used in checking and making comparisons. For example, an entire bulkhead drawn to small scale on one sheet, and carrying the usual enlarged details worked out for all field joints, is practically all the foreman needs in directing its assembly.

The close supervision possible when details are worked out on the drawing board is a feature that is highly commended. The number of rivets in a gusset plate, for example, is now determined according to exact analysis by a structural detailer, instead of by the man working on the floor of the mold loft. Of course it will always be desirable to make up templets for many parts,



PART OF A TYPICAL DETAIL SHEET—AN UPPER DECK STRINGER PLATE



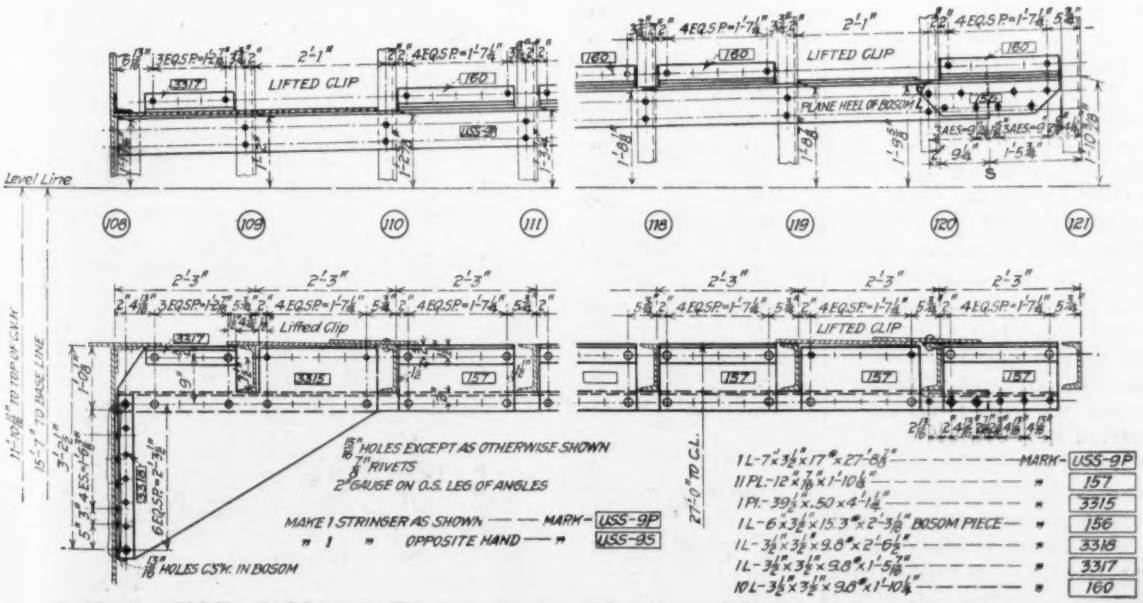
PART OF DRAWING OF A BILGE PLATE; PORT AND STARBOARD PLATES SHOWN ON SAME SHEET

just as it is desirable to keep shipfitters on the assembly work. But templets are now made up according to a blueprint. It is notable that this plan simplifies the problem of obtaining or training men for mold-loft work. Benches have been put in the mold loft on which to make up all but the largest templets. This is believed to have increased the efficiency of the force by about 25 per cent., besides making it much more comfortable for the men.

Perhaps the greatest advantage of all is the use of the blueprints by inspectors in a careful checking of plates and shapes before they leave the shop. This has resulted in the catching of errors before the piece gets into the ship and is, perhaps, partly riveted into its proper place.

With the old system the elaborate markings on the pieces, usually done with a paint brush, could not always be trusted, because there was no means of securing a second check, such as is now made with a blueprint in the hands of an inspector.

Because of the necessity of keeping the yard up to maximum output while the change from templet to blueprint method was made, the transition has had to progress slowly. It has been possible to make steady progress on the detailing and attend to other incidental drafting with a force of about 34 detailers. The most


LIFTED CLIP
PLANE HEEL OF BOSOM
Level Line
108
109
110
111
118
119
120
121
Lifted Clip
11'-10⅛" TO TOP OF G.W.H.
15'-7" TO BASE LINE
⅞" HOLES EXCEPT AS OTHERWISE SHOWN
⅞" RIVETS
2" GAUGE ON O.S. LEG OF ANGLES
MAKE 1 STRINGER AS SHOWN — MARK- USS-9P
" 1 " OPPOSITE HAND — " USS-9S
⅞" HOLES CSK. IN BOSOM
27'-0" TO C.L.
1 L-7" × 3½" × 17" × 27'-8⅞" — MARK- USS-9P
11 PL.-12" × 7/16" × 1'-10⅛" — " 157
1 PL.-39½" × .50 × 4'-1¼" — " 3315
1 L-6" × 3½" × 15.3" × 2'-3⅛" BOSOM PIECE — " 156
1 L-3½" × 3½" × 9.8" × 2'-6½" — " 3318
1 L-3½" × 3½" × 9.8" × 1'-5⅞" — " 3317
10 L-3½" × 3½" × 9.8" × 1'-10⅛" — " 160

UPPER SIDE STRINGER REPRESENTED IN TYPICAL STRUCTURAL-DETAIL MANNER; FRAME NUMBERS SHOWN IN CIRCLES

intricate part of the designing has been on those sections of the stern where warped surfaces intersect, known as the "lift plates," the templets for which were formerly made directly on the form of the ship. These have been laid out to scale by developing the surfaces involved. Plates built according to designs so prepared have thus far been satisfactory.

W. H. Cullers is chief engineer and C. D. Merrill is naval architect for the Northwest Steel Co. John Murray is general yard superintendent.

Irrigation Opportunities in Russia Are Great

Chances for Both Public and Private Enterprises—Cotton the Great Crop in Arid Russia but Insufficient for Russian Spindles—Agriculture on Steppes Conducted by Dry-Farming Method

By V. V. Tchikoff

Formerly Chief Engineer of Surveying and Designing Works in the Central Part of Golodnaya Steppe, Turkestan, and in the Lower Part of the Valley of the Dnieper River, Taurida, Russia; now of Berkeley, California.

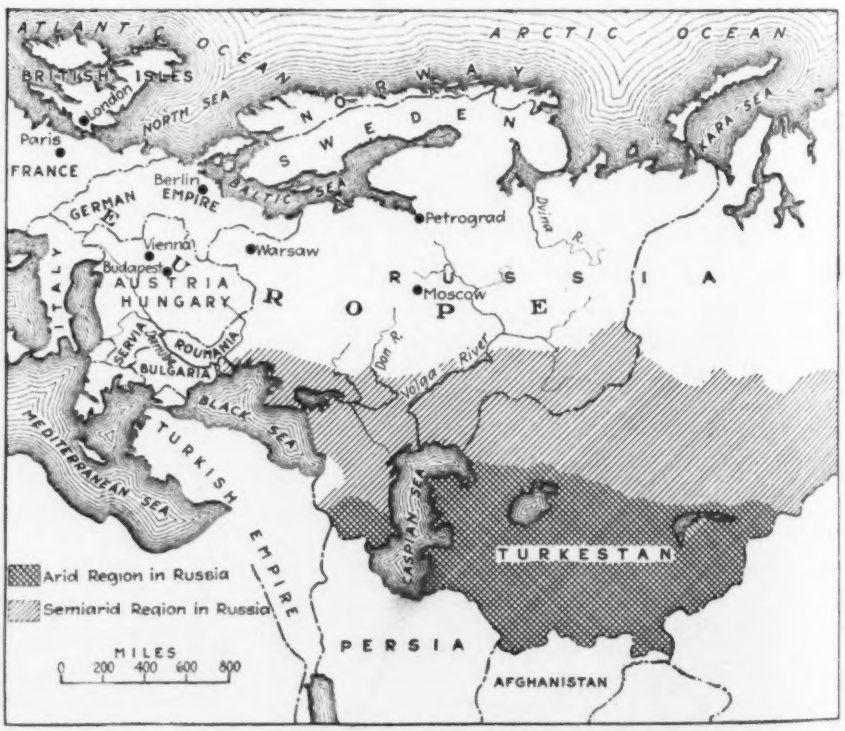
COMPARATIVELY little has been written in English about irrigation in Russia. A few articles in some magazines and a few pages in Dr. Samuel Fortier's work, "Use of Water in Irrigation," give some data. In this article I intend to fill up the gap as much as possible.

Irrigation in Russia is confined mostly to the southern part. Climatically this region may be divided into two parts, the arid and the semi-arid, as shown by the accompanying map.

The arid region, with a semi-tropical climate, comprises Russian Turkestan, including Transcaspia, Bokhara, Khiva and Transcaucasus, where about 10,000,000 acres are irrigated. Since there is very little precipitation during the growing period, agriculture in this region depends entirely on irrigation. The quantity of precipitation is variable, reaching in some places, as in Transcaspia, about 2.5 in. a year, while the evaporation is about 40 times greater. In Tashkent, the capital of Turkestan, the yearly amount of precipitation is comparatively large, averaging 356 mm., reaching 231 mm. in the driest year and 502 mm. in the year of greatest humidity. But during the growing period (from April to October, inclusive) the mean amount of rainfall is 138 mm. Of this amount 86 mm. falls during summer (June, July) and 34 mm. during autumn (August, September and October). Tashkent is situated in latitude 41° 20′, and 1570 ft. above sea level. Its average temperature for the year is 13.4° C. and the average minimum in January —6.2° C. The hottest month is July, with the mean temperature 27.40° C. The length of the irrigation season averages about 200 days, from Mar. 15 or Apr. 1 to October. In the foothills of the mountainous regions of Turkestan agriculture without irrigation is possible but only on a small scale except in the Semiryechenskaja province, where the cereal yield is large. In the arid region, irrigation farming has been practiced for innumerable years in a very primitive way. Ferghana province in Turkestan represents the biggest center, with the largest canals delivering water from the river Syr Daria.

Side by side with the old local systems of irrigation there were started and completed by the old Russian Government some new irrigation projects. Among these may be mentioned the project of the Murgabovo estate, which was built at the expense of the family of the czar for the irrigation of about 100,000 acres. The water was supplied from the Murghab River, on which were constructed a number of reservoirs with earth dams.

Recently there has been finished an irrigation project of 150,000 acres in the so-called Golodnaya (Hunger) steppe in the Syr Daria province in Turkestan, and three projects in Muganskaya, Milskaya and Karabah-



IRRIGATION IN RUSSIA IS PRACTICED MOSTLY IN THE SOUTHERN PARTS

skaya steppes in Transcaucasus. The whole Hunger steppe occupies an area of about 1,250,000 acres; Milskaya, 400,000 and Karabahskaya, 235,000 acres.

During the war there was started an irrigation project in the Semiryechenskaya province as one of the measures for obtaining lands on behalf of the returning soldiers, the heroes of war.

Pumping plants are operated here and there in the valley of Syr Daria, Murghab, Tendgen and other rivers, but more than 99% of the irrigation is from gravity canals. The water for irrigation in the arid region comes from streams which have their sources in the mountains. Because of the melting glaciers and snows, the flood season of most of the rivers occurs in summer, which is very beneficial for irrigation. In most cases the summer supply of small rivers is so small that the natives are able to handle them. But the winter discharge and part of the flood discharge even of the small rivers is left unutilized, and in many cases some reservoirs could be easily built and exploited.

The largest water sources of Turkestan, the rivers Amu Daria and Syr Daria, even without construction of reservoirs, have so much unused water that they would be sufficient to irrigate an additional few millions of acres of very fertile soil.

Bureaucratic Methods Hampered Development

Although surveys were made and data collected during the past decade which should considerably facilitate future irrigation projects, still more data are needed. Bureaucratic methods of conducting work in the public domain have greatly hampered Government and especially private enterprises. Some will remember the trip of A. P. Davis, director and chief engineer of the United States Reclamation Service, to Turkestan to investigate the practicability of constructing a large canal from the river Amu Daria to irrigate the Merv oasis. This enterprise was doomed as untimely. In other districts, as for instance in the Hunger steppe, Ferghana, etc., where the profitableness and usefulness of the erection of new systems could not be doubted at all, the old Russian Government put many obstacles in the way of private enterprises.

With difficulty there was started by private capital during the war the construction of a large project for more than 100,000 acres in the Shirabad valley, Bokhara, utilizing the water of Surkhan River near its junction with the Amu Daria, at the frontier of Afghanistan, near Termes.

Generally speaking, there is still a very small area newly irrigated in Russia, either by the Government or private capital.

Agriculture in the largest part of the arid region of Russia is almost entirely for the production of cotton. These are the only districts in Russia where cotton is cultivated. In the last few years before the war the Russian market supplied only about one-half of the cotton used by the manufacturers in Russia, the other half being imported. In 1912 the Russian mills used about 25,000,000 poods (one pood = 37.12 lb.) of raw cotton, of which was imported through European frontiers about 35% and through Asiatic frontiers about 8%. Cotton imported into Russia through European frontiers in 1912 was 8,986,145 poods, or about 665,000 bales, nearly all American. In 1912 more than 500,000 bales of United States cotton was taken by Russia through the hands of Germany, compared with 112,000 bales imported directly from the United States.

The cultivation of cotton occupies a comparatively large area in the arid region of Russia. In several places of Ferghana province, Turkestan, about 90% of the cultivated area is under cotton. On the average, in the whole Ferghana there was under cotton about one-third of all the irrigated land. The Russian agricultural experiment stations regard as most favorable the rotation with one-third of the land under cotton and one third under alfalfa.

Normally, Russia ranks third among European countries in number of cotton spindles. Most of the mills are in the central or Moscow spinning district.

Irrigated Agriculture Profitable

Agriculture in the arid region is very profitable. In Turkestan, for instance, the rent for the irrigated area is mostly paid from part of the crop. Land rented for cotton cultivation generally brings in Ferghana and Transcaspia half of the crop. The mean yield of raw cotton is about 60 poods per dessiatine, or nearly 800 lb. per acre, reaching as high as 1600 to 2000 lb. The cost of construction of an irrigation project was before the war from 75 to 200 rubles per dessiatine or about $15 to $40 per acre.

Figuring the rent as the sum of half or even a third of the crops at the prices as they stood about before the war, the cost of construction of the irrigation systems could have been paid off in only a few years. The big profit of cotton cultivation brought to the cotton growing region hundreds of enterprising men, ready to irrigate the desert land.

The new cultivation of large projects, say about 100,000 acres, would present an altogether different problem. The main problem in the creation of new irrigation systems lies not in the engineering difficulties, but in the selection of settlers and in the successful settling of the land in the shortest possible time.

The conditions of Russia in this respect before the revolution were as follows: There existed in Russia a constant migration of landless peasants. Although Turkestan and Transcaucasus were temporarily closed to settlers, the wave of migration reached even these regions and formed there some so-called "self-willed" villages. Moreover, there is in the oases of the arid region a native population so dense and land hungry, many of them being tenant farmers, that they form quite a shifting element, always ready for settlement of new irrigation projects.

Should the primitive methods of cultivation with native implements be supplanted by modern agricultural machinery, it would also help the exploitation of the new irrigation projects.

As a result of the Russian revolution the land resources of the Russian peasants will probably be improved, so that the emigration to Turkestan should be lessened, but this may influence only the size of the area to be newly irrigated.

In view of the fact that the demand for cotton is great and that the possible supply of unutilized water and land is abundant, irrigation in Turkestan and other

places of the arid region should be one of the first big problems of New Russia.

The importance of irrigation in the semi-arid region presents a problem of an altogether different character. This region comprises the southern and southeastern part of European Russia, the steppe provinces and western Siberia. The unpropitious conditions for farming in this vast region are mostly due to lack of precipitation as well as to its great fluctuation. The unfavorable periodic distribution of rain was disastrous to farming in some provinces, and the old Russian Governmnet often had to undertake public works and other measures of relieving the population stricken by crop failures. The suffering is especially acute in a whole row of provinces on the middle and lower part of the River Volga.

During the present war large sums of money were appropriated for irrigation and similar works in the above mentioned provinces; investigations were undertaken with the same purpose in southern Russia, north Caucasus and in some places in Siberia.

Among the unfavorable conditions for the development of irrigation projects in this region is the difficulty of getting water on to the land. Most of the rivers have eroded themselves deeply into the ground, and utilization of their water would require lifting to a great height. The underground waters are deep seated. The little streams of the steppe, being fed by precipitation, mostly bring their water in the spring during the thawing of snow. Reservoir construction would insure water for only a small per cent of the area. Only in the delta and in the overflowed land of some big southern rivers—Dnieper, Don, Kuban, Terek, Dniester, part of the Volga—would comparatively large irrigation projects be practicable, and these would involve the construction of levees.

Generally speaking, the irrigated area in the semi-arid region will appear as rare spots in the vast steppes, where agriculture is conducted under the method of dry farming. There are at present about ten such irrigated plots. In the semi-arid region of Russia, and especially in some parts of the steppe provinces and western Siberia, the supply of water for domestic purposes is of the first importance. There is a great similarity between the semi-arid region of Russia and that of the United States and Canada. The steppe region in Russia equals the prairie region of North America.

Fruit Culture in Russia

Crimea, Bessarabia, Caucasus and Turkestan yield the biggest supply of fruit. Apricots, peaches, quinces, pomegranates, figs and almonds grow in the open air in these provinces. In some places of Transcaucasus even oranges and lemons grow.

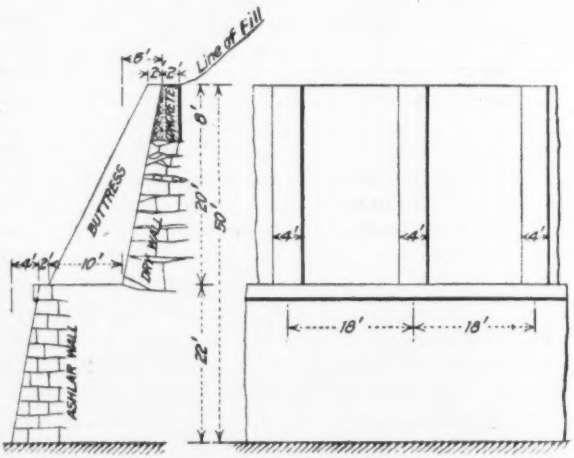
The Crimea is the chief growing center. Crimea bears the same relation to the rest of Russia as Southern California has for the United States. In the article of D. Kotcherin, "Russian Engineers Make Intensive Hydrometric Survey in Crimean Upland," in *Engineering News-Record* of Apr. 4, 1918, p. 657, are given some data on irrigation in the Crimea. The streams, with few exceptions, run dry two or three days after a rainstorm. The fluctuation of the discharges is very large. The slope of the streams is so great that the valuable agricultural lands are often destroyed by storm water. The sources of irrigation are small and the water values very high. What is necessary for Crimea is a proper storage of water, an increase of the use of underground water and the economical methods of irrigation followed in southern California.

Holding a Bulging Retaining Wall With Buttresses

High Fill of Slippery Material Forces Out Dry Wall—Grouting and Buttresses Solve Difficulty Satisfactorily

IN BUILDING the low-grade freight line of the Pennsylvania R.R. some years ago from Columbia, Penn., to Trenton, N. J., a high fill was made across a narrow ravine on the bank of the Susquehanna River near Safe Harbor, Penn. This fill was made largely of cinders, and is about 550 ft. long and 130 ft. high. At the foot of the fill runs the single-track line of the Maryland Division, about 40 ft. above the Susquehanna River.

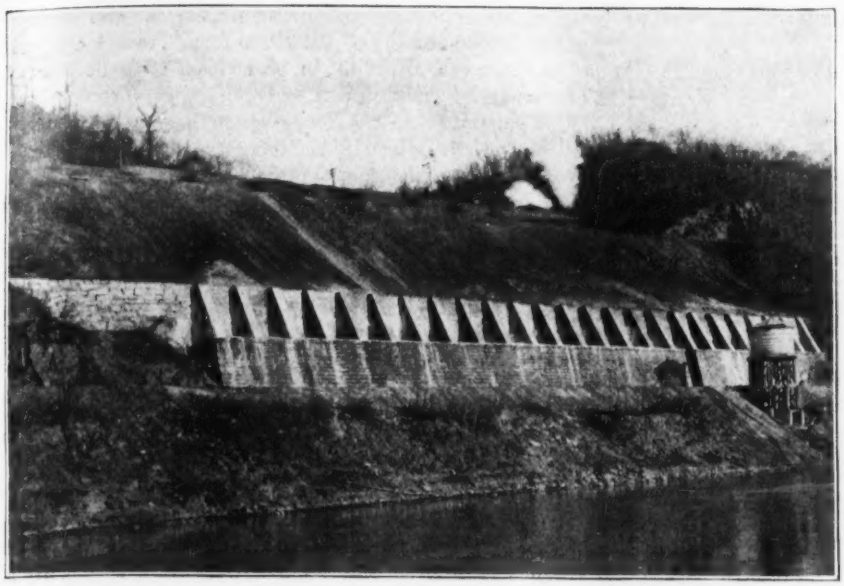
In order that the fill might not encroach on the track at the lower level, a masonry retaining wall was built, 24 ft. high, with a face batter of 4 ft. This wall proved



CROSS-SECTION AND FRONT ELEVATION OF RETAINING WALLS AND BUTTRESSES

strong enough to stand the outward pressure but not high enough to retain the slippery cinders. Some years later, therefore, a dry masonry wall was built on top of the lower retaining wall. This dry wall was started 12 ft. back of the top of the lower wall and was carried up to a height of 22 ft. Still later a wooden cribwork 8 ft. high was placed on top of the dry wall.

In November, 1917, it was found that the dry wall was bulging from the pressure of the fill behind it, and it was deemed necessary to undertake repairs to make the roadbed safe. Several plans were considered, among others the construction of a concrete wall 12 ft. high placed on top of the lower masonry wall, to hold the dry masonry from further movement. Another proposal was to place a form in front of the dry wall and one foot away from it, and fill the space between with



VIEW TAKEN AFTER DRY WALL WAS GROUTED AND BUTTRESSES WERE BUILT

concrete, which would of course work back more or less into the interstices of the dry wall.

A plan was finally suggested and carried out under contract by Harold P. Brown, of New York City, involving the strengthening of the bulging dry wall with a series of buttresses, each 4 ft. wide and 40 ft. high, placed 18 ft. apart. Between these buttresses Mr. Brown proposed to fill the dry wall with concrete, and then face the surface with his concrete atomizer. The buttresses were to be connected at the top by a concrete wall 8 ft. high built on top of the dry wall.

It was necessary to carry on this work, however, without interrupting the traffic on the single-track line of the Maryland division which ran close to the foot of the lower retaining wall. The materials for the work were brought on this line. A side track was constructed outside the main line and parallel with the top of the retaining wall. A line of rail was laid along the top of the retaining wall and a traveling crane was constructed with its lower leg supported by a flat-car on the siding and its upper arm reaching across and traveling on the rail laid on top of the retaining wall 24 ft. above. On one end of the flat-car a tower was built, and a timber truss bridge reached from the top of the tower to the retaining wall.

The wheels which carried the end of the bridge resting on the wall had long axles, loose in their bearings, so that accurate lining up of the side track with the rail on top of the wall was not necessary.

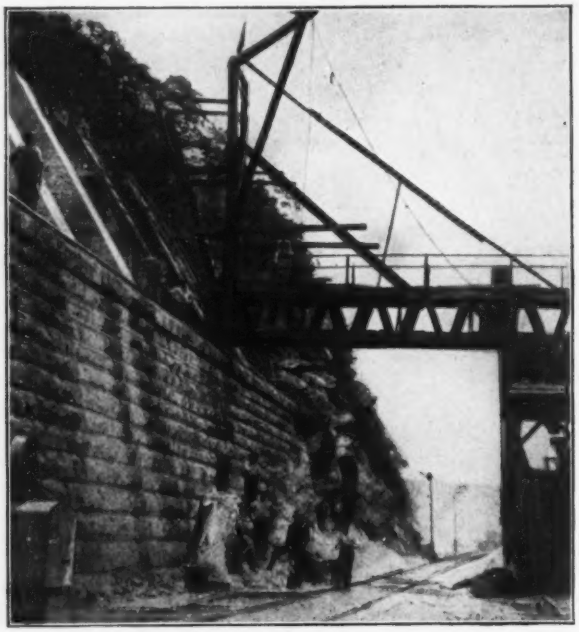
On the end of the bridge nearest the wall was set a light jib crane and also an inclined frame through whose uprights timbers could be shoved forward horizontally as far as the face of the dry wall to support scaffolding at any height.

On the end of the flat-car opposite the tower was placed a 45-hp. boiler, and between the two was a double-drum hoist. A Brown concrete mixer and steam atomizer for delivering concrete through hose was located at the bottom of the tower. On the level above was placed a measuring box discharging the concrete materials into the mixer below, and above the mixing box were bins with under-cut gates for sand and gravel. These materials were brought in by rail and were unloaded and placed in the bins by a small jib crane at the corner of the tower. Work was begun at the sixth panel, where the dry wall showed the greatest bulging and apparent danger of sliding. In filling the first panel a very large quantity of concrete was used, and the material appeared at openings in the dry masonry wall on a frontage of 90 ft. and also showed up nearly 90 ft. back of the front line of the wall in a culvert which extends underneath the fill. The jib crane on the traveling bridge proved very convenient in setting and placing the forms for the buttresses, as well as in raising the grout and the concrete.

To provide an added factor of safety against any movement of the completed structure under the pressure of the fill behind it, steel tension members cut from old car truss-rods rescued from the scrap pile were embedded in the heel of the buttresses, the lower end being carried down to a secure anchorage. The entire work of buttressing the wall was carried on to completion without interfering in any way with train movements.

Mr. Brown and his associates designed and supervised the work, the railway company furnishing the

BULGING DRY MASONRY WALL UNDER A HIGH FILL



TRAVELING TOWER-CRANE SPANNING MAIN-LINE RAILWAY

labor and materials; the whole was under the direction of Elmer Irving, division engineer of the Pennsylvania R.R. at Harrisburg, Penn.

Chicago Plan Commission Proposes Great Improvement Scheme

A COMPREHENSIVE program for the development of the City of Chicago, as a means of meeting the problems of the reconstruction period, has been submitted to the mayor and the city council by the Chicago Plan Commission. The individual projects are not new and some are already under way, but the program lists them all as component parts of one great scheme of improvement. The projects in the downtown portion of the city are shown on the accompanying map. The projects which are under construction and should be pushed vigorously, according to this program, are as follows: Widening Twelfth St. to form a new thoroughfare between the west side and the lake front; widening and extending Michigan Ave. to form a direct connection between the North Side and South Side boulevards, including a double-deck bridge over the river; revision of the West Side terminals, with construction of the new union station and the widening and double-decking of Canal St. from Twelfth St. north to the river, which is to be crossed by a double-deck bridge at Kinzie Street.

Completion of the outer circle boulevard from the lake, on the North Side, along the Des Plaines River and through the forest preserves. Only two miles of this remain to be formed by the opening of Rogers Avenue.

The projects already formulated, but not yet commenced or officially adopted, include the following:

Revision of the Illinois Central R.R. terminals, with a new passenger station, electric operation, track elevation and harbor and park development along the shore. All this is covered in an ordinance submitted recently by the Railway Terminal Commission.

Straightening the south branch of the Chicago River to improve the street layout and give opportunities for property development.

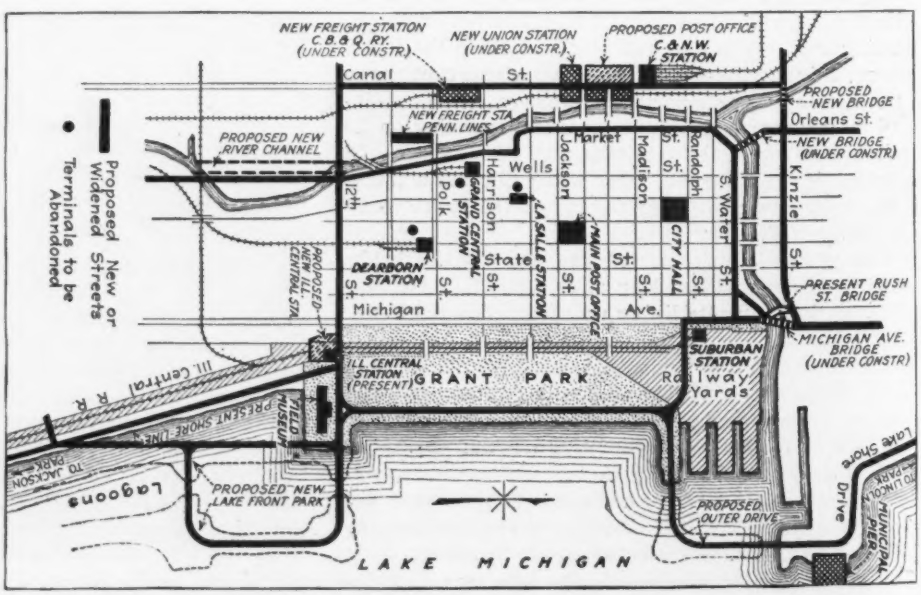
The removal of three South Side passenger terminals to the new Illinois Central terminal on the lake front and the revision of freight terminals, thus opening a number of important streets now closed by railway yards and tracks, and releasing valuable property now occupied by freight yards.

Extending Ogden Ave. to form a new diagonal thoroughfare between the northeast and southwest districts, thus diverting considerable traffic from the congested loop district and opening up a new industrial district.

Widening Western Ave. and widening and extending Ashland Ave. and Robey St. to form two continuous thoroughfares. These are three north and south streets on the West Side of the city.

Improving So. Water St., which is now practically a produce and poultry market, and reclaiming it for public use. This includes a double-deck construction.

Building an outer drive along the lake front to connect the north and south parks, and thus afford an independent route for the use of pleasure traffic, also boulevards along the right-of-way of the Drainage Canal.



SOME DOWNTOWN IMPROVEMENTS ADVOCATED BY CHICAGO PLAN COMMISSION

The construction of a new West Side postoffice, adjacent to the West Side railway terminals, where 62% of the city's mail is handled.

Other matters advocated are the completion of the city's bridge program; the settlement of the rapid-transit controversy; the development of the forest reserves, and the construction of highways connecting Chicago with the good-roads system of the state. The Chicago Plan Commission also indorses a new city charter, the study of the zoning and housing problems, and passage of an excess condemnation act to eliminate objections to the present method of making public improvements.

Appropriations are recommended for preliminary work on the Ogden Ave., Western Ave., Ashland Ave., Robey St. and So. Water St. improvements noted above.

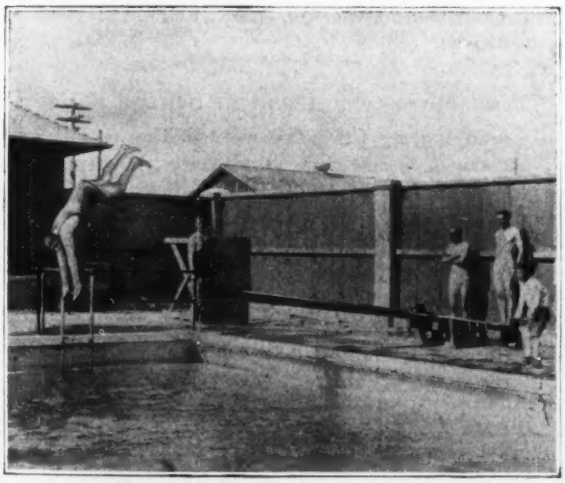
Reinforced-Concrete Swimming Tank Was Carefully Designed

Fort Bliss Pool Has Combined Wave Break and Scum Gutter—Adjustable Springboard Holder—Form Details

By R. McC. Beanfield
Captain of Engineers, United States Army, Camp A. A. Humphreys, Virginia

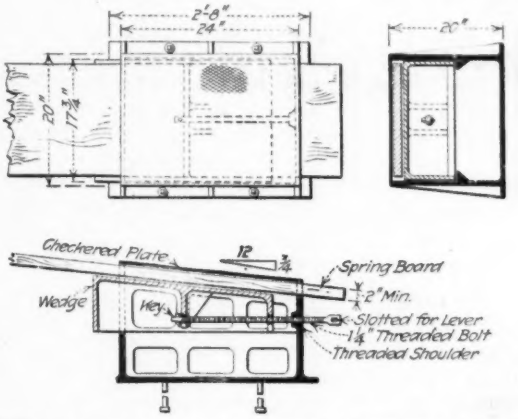
IN THE design and construction of the reinforced-concrete swimming tank at Fort Bliss, Texas, many interesting details were worked out which may contain suggestions for engineers contemplating the design of a swimming pool.

For a tank large enough to meet the requirements of this post, considerable study had to be given to the economics of the problem, as the money available, do-



DIVING FROM ADJUSTABLE SPRING BOARD

nated by the War Camp Service Board of El Paso, was limited to $2500. The tank was built with skilled labor—such as carpenters, men handling the concrete mixer and cement finishers—furnished mostly by the battalion of the 8th Engineers (Mounted). This enabled the engineer troops to obtain practical instruction in work closely related to their future duties—the building of concrete dugouts, gun emplacements, and the like. For common labor prisoners from the Fort Bliss prison stockade were used. A ½-yd. concrete mixer and four concrete buggies were lent by an El Paso contractor. Sand was obtained close to the site of the tank, and was screened and loaded by prisoners into Army wagons. Trap rock for concrete was hauled to the job by Government auto trucks. The $2500 donation, therefore,



SPECIAL CASTING FOR ADJUSTABLE SPRING BOARD

was utilized only for the purchasing of materials required in the construction of the tank. These materials were supplied at cost by El Paso merchants.

From previous experience in the design of swimming tanks, the writer based the present one on the following fundamental requirements: (1) Locate below the natural ground the level part of the tank and use the excavated material later as fill around the walls of the tank above the natural ground level—this economizes in excavation and grading; (2) cast each side of the tank as a monolithic unit up to the water line designed as a cantilever wall—this results in a minimum of construction joints and the most economic wall section; (3) cast the bottom, or floor, of the tank as a monolithic unit, independent of the walls and wall footings—this tends to eliminate cracks due to unequal settlement and shrinkage; (4) locate expansion joints of the diaphragm type in each corner of the tank, to facilitate the construction by reducing the joints to a minimum; (5) install a combination scum gutter, overflow and wave break, of concrete cast with the wall; (6) construct the tank of proper shape and size to hold swimming contests regulated according to the National Amateur Athletic Association rules.

The tank is 40 x 100 ft. in plan, with a maximum water depth of about 9 ft., a water depth of about 7 ft. at the diving end and of some 4 ft. at the other end. For future work the writer suggests a 6-ft. water depth at the diving end, with a maximum depth of 8 to 9 ft., some 16 to 25 ft. from that end wall.

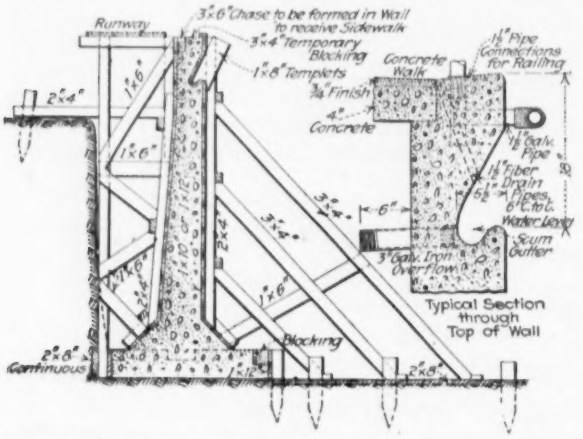
The site on which the tank was located had a surface stratum of 4 to 5 ft. of caliche, under which a deep layer of sand was found. The excavation was started by a rooter plow, which broke the caliche sufficiently to permit its excavation with fresnos and slip scrapers.

The accompanying sketch of the wall form shows a very efficient method of exterior bracing.

The concrete was proportioned for maximum density on the basis of a 1 to 6 mix. No integral waterproofing was used. The consistency of the concrete was

gaged by the visual test; that is, by keeping the stone always in suspension in the mixture. Some of the concrete was mixed by hand for practical instruction. Each side of the tank was poured continuously until completed. The walls could have been poured up to the water line in one operation, which would have facilitated the work, as the scum gutter forms were somewhat difficult to strip in order to avoid breaking of the nosing of the scum gutter. Before the 6-in. floor of the tank was poured, the sand subgrade was well compacted with water and tamped. The 6-in. base was poured continuously until completed. Negative moment was provided for by bending the slab reinforcement up at all supports.

The scum gutter was designed to serve both as a wave break and as an overflow and drain to collect floating



WALL FORM BRACING AND DETAIL OF SCUM GUTTER

débris and scum. The water draining into the scum gutter flows through 3-in. drain pipes to a drop manhole in which is set an 8-in. gate valve, with an extension key, which controls the discharge line. An open invert in the concrete base of the manhole connects the gate valve to an 8-in. terra-cotta pipe line 250 ft. long, which is connected with one of the manholes of the Fort Bliss sewer system. The invert eliminates a rather difficult joint between the screw flange of the gate valve and the terra-cotta drain pipe. By reason of the open invert, a leak in the gate valve can be easily seen. The drains lead from the scum gutter and discharge directly into the manhole, eliminating connections to the discharge pipe.

Often the rungs of ladders for use in swimming tanks are made of small diameter bar iron or other material which tends to hurt the feet. The ladders for the Fort Bliss tank were entirely constructed of 1½-in. galvanized-iron pipe. The fittings for the ladder and part of the fittings for the hand rails were reamed to permit the pipe to pass through them. The fittings were afterward bored for setting countersunk rivets, which were filed smooth with the pipe surface.

Expansion joints were located at the four corners of the tank. The joint was made with two 24-gage galvanized iron diaphragms, notched for bond, with hot California asphalt poured between the diaphragms. The joints were carried up only to the top of the scum gutter. A plain asphalt paper construction joint was used from the scum gutter to the top of the tank. A board covered with asphalt paper was used to form the joint while the concrete was being poured. After the concrete had set a little the joint board was carefully pulled from the joint.

A two-ply, 14-lb. felt, mopped in hot asphalt, was laid on top of the 6-in. concrete floor to serve as a waterproofing membrane. A 3-in. 1 : 6 mix concrete slab, divided into 10-ft. squares by asphalt joints, was placed over the membrane coat to protect it.

A 5-in. 1 : 7½ mix concrete floor subdivided by two marginal brick joints was placed around the entire tank. The brick joints were placed as planes of weakness, separating the greater part of the slab on the fill from those parts bearing on the walls of the tank and on the curb beam between the columns, thus avoiding unsightly cracks should the fill settle. The brick were especially chosen for their varying colors. Between the ¾-in. deep V-grooved joints the slab received a troweled finish followed by a toothed roller which neatly roughs the smooth finish, preventing slipping.

A special casting designed by the writer was used as a spring-board holder. This holder contains a cast wedge, adjusted by means of a screw bolt turning in a threaded shoulder cast with the exterior frame, that clamps the spring board at any desired length, thus varying the elasticity of the board as well as increasing its life.

The swimming tank, in addition to its use for bathing, is available as the source of an auxiliary water-supply for fire fighting, an important feature in isolated Army posts. The water in the tank is sterilized with hyperchlorite.

The work was done under the direction of Col. V. L. Peterson, commanding the 8th Engineers (Mounted). The writer designed the tank and supervised its construction.

Direct Microscopic Count of Sewage Bacteria

In studying, by the usual method, the agglutination of bacteria and attempts to separate masses of these organisms before plating, Milton F. Stein, Chicago, investigated the direct microscopic counting method, using a blood-counting cell. His results were described in the course of a recent paper read before the sanitary engineering section of the American Public Health Association. In one instance, where the average of 10 tests by the usual method gave 3,950,000 per cubic centimeter, the direct count gave 70,720,000 as the average of 10 counts made by two observers. Mr. Stein attempted, by shaking for various periods, to separate bacteria clinging in bunches to particles of foreign matter. For the 10-min. period the increase was 67% over the usual method. He concludes that the number developed by plating is not over 10% of the total number present. A review of the governing conditions indicates that no constant proportion can exist, that under unusual conditions the standard method gives distorted results, and that for special work modifications to reduce these distortions seem advisable. The full paper, which is a mathematical discussion of chances of error in water and sewage bacterial counts, was published in the November *American Journal of Public Health.*

Medical Inspection at Miami Camps Checks Influenza

First-Aid Hospitals, Local Doctors and Chief District Physician Held Back Epidemic at Five Conservancy Dams

MEDICAL inspection reduced to barely a score of mild cases sickness from influenza at the five dam-construction camps, housing some 400 persons each, of the Miami Valley flood-protection works. The methods, somewhat intensified for the period of the epidemic, were those regularly provided for protecting health and caring for injuries on this work. They comprise attendance of a physician and provision of a small first-aid hospital at each camp and, if the cases are serious, removal to city hospitals.

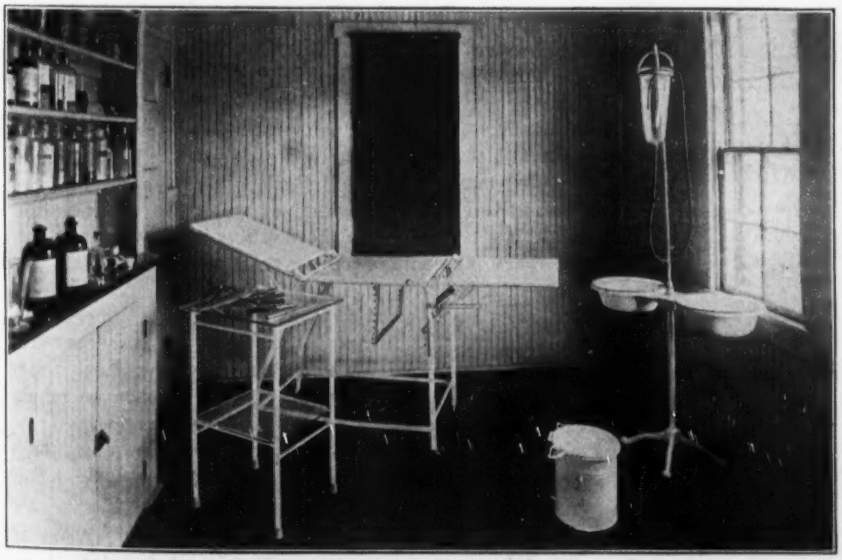
Local physicians at the camps and a chief physician at headquarters compose the medical staff. The chief physician gives all his time; the local physicians, one for each camp, serve only on call, except at the Huffman Dam, where a doctor gives all his time to the camp work. The procedure is about as follows: The camp overseer or superintendent is held responsible for first aid and for calling the local physicians and notifying the chief physician. If the case is serious and the worker has no home of his own, or if he requires better care than is practicable at home, he is sent to the city hospital. The Conservancy District assumes no financial responsibility for cases of sickness, except that the chief physician on his regular inspection trips visits the sick person without charge. For special visits payment is asked.

At each camp a hospital building is provided and equipped for first-aid work and as an office for the physician when he is at camp. All the essential features of these field hospitals are indicated by the illustrations. So far during the work no serious accidents have occurred and sickness has been rare. The medical staff and the sanitary inspectors proceed always on the theory that prevention is better than cure.

Direction of camp hygiene is in the hands of Dr. W. M. Smalley for the Miami Conservancy District. Arthur E. Morgan as chief engineer, Charles H. Paul as assistant chief engineer, and C. H. Locher as construction manager for the district supervise all activities.

FIVE CAMP HOSPITALS GIVE FIRST AID TO EMPLOYEES

At the outbreak of the influenza epidemic, the district camp inspector and the chief physician immediately took steps to safeguard the camps. It was arranged that the resident physician at the Huffman Dam should visit the cottages there and at the Taylorsville Dam; that the chief physician should visit the camps at Englewood and Germantown, and that a local physician should similarly care for the camp at Lockington. These visits were much more than perfunctory. The physicians interviewed the workmen and their families, gave instructions regarding the nature of the disease, the symptoms denoting it and the steps to be taken, emphasizing the necessity of prompt action and of calling a doctor at once. In addition, the district printed a circular which was distributed through all the camps and which was in effect a repetition of the instructions given orally by the physicians. Only a few scattered cases of influenza developed. At Englewood there were seven or eight cases, at Huffman three or four, at Germantown five or six, and at Taylorsville only one or two. Only two cases of the disease, however, could be classed as severe.



OPERATING ROOM IS EQUIPPED WITH ALL APPARATUS REQUIRED FOR FIRST-AID

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Growth Chart on Postcard Boosts Society Membership

In a new-member campaign being pushed by the Iowa Engineering Society, postcards the size of a blotter are distributed, showing a chart of the growth, since the organization started 30 years ago with 40 members, to the present membership of 220. At the side of the chart are these "selling" arguments: "Is it worth while to broaden your acquaintance, to contribute your share to the progress of the engineering profession, and to serve the highest interests of state and nation in wholehearted coöperation with your professional brothers?"

A census of all engineers in Iowa is proposed, the state to be districted to correspond with a membership of a special committee which represents the various sections and organizations of the state. If possible, a permanent system is to be developed to keep the census up to date. Based upon this census, local clubs can be formed and affiliated with the state society.

Duluth Engineers Propose United Society for Nontechnical Work

A combined organization, formed by the coöperation of all of the recognized societies, to supplement, but not supplant, the latter, is a step proposed by the Duluth Engineers' Club, which has appointed a committee representing the four national societies of civil, mechanical, electrical and mining engineers and the chemical society. Technical work would be carried on by the separate societies as at present, the new organization dealing with such matters as the status of the engineer, his relation to the public, ethics, employment and publicity. According to a circular issued by the committee, the new combination must not destroy the identity of the present societies; it must take their good points, add what may be desirable and eliminate any undesirable features.

Iowa Society Will Promote License Bill and Encourage Affiliations

At a recent meeting of the executive committee of the Iowa Engineering Society, it was decided to present to the next legislature a bill for the licensing of engineers. It was considered desirable to carry out the plan previously developed for this end as the war is practically finished and the reconstruction period is at hand. It was decided also to proceed with the plans for forming Iowa sections of the national societies of civil, mechanical and electrical engineers, with a view to affiliating these with the Iowa Engineering Society. In fact, it is hoped to affiliate all the engineering societies of the state in one united state society, with the idea that if other states take similar action it will be possible eventually to form one national united engineering society, comprising nearly all the nation's engineers.

Local Society Admits National Society Members Without Fee

For some time the Engineers' Society of Western Pennsylvania has been omitting initiation fees of candidates who were already members of the four Founder societies. In addition, on Oct. 1, the Board of Direction approved recommendations of the membership committee that members of the American Chemical Society be admitted as associates on the same basis. Following this order, the question of organizing a chemical section was taken up. The proposition of adding still further to the accredited list of societies whose members would be exempt from initiation fees was discussed with the request that the Society for the Promotion of Engineering Education be considered by the membership committee.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

C. L. Christensen Replies to Dr. Steinman on Equivalent Uniform Loads

Sir—Permit me to make some few concluding remarks in answer to Dr. D. B. Steinman, in your issue of Dec. 26, 1918, p. 1193.

1. The uniform load method proposed by me is not intended for cases where Dr. Steinman's carefully worked out values can be used, but for cases in which they cannot be used. I stated this clearly in my preceding letter, but Dr. Steinman seems to lose sight of it.

2. The error made in using Dr. Steinman's curves for reversal is not small. In a design for a 640-ft. two-hinged arch it amounted to about 35% in the reversal live-load stress, and more than 10% in the resulting design stress for the diagonals adjacent to the center vertical. In a 252-ft. simple through truss span the inaccuracy in the reversal stresses for the diagonals near the center was about 25%, but in the resulting design stress it was only 5 per cent.

There is nothing far-fetched or unusual in computing the actually occurring reversal stress, since the A. R. E. A. specifications, as well as the New York Central R.R. specifications call for this. Dr. J. A. L. Waddell makes a clear distinction between reversal occurring during the passage of the train and reversal occurring later for a different live load, and calls for a higher percentage of reversal to be used in the former case.

It may have occurred to many bridge designers that the requirements in case of reversal are rather severe for long-span bridges, since it may take more than 5 sec. to make the reversal. There is then so much more reason for being exact and not extravagant in adhering to the specifications; otherwise the result will be a freakish detail design for the panel point and a waste of material and rivets.

3. Dr. Steinman states that by applying the uniform load method proposed by me the amount of error found was from 2% to 5%. I believe that an error of 5%

can only be found in case the loading is used to find the end reaction for a 200- to 250-ft. span. In case of finding the end reaction, the pilot wheel is not on the bridge for the E 65 loading; this upsets the proportion between the exact loading and the substitute loading; the latter was of course not intended for use in finding end reactions for Cooper's loading—neither were Dr. Steinman's curves, as the end reactions are given in a separate table. Neither is it my intention to propose the 8500 lb. per 100 ft. followed by 6500 lb. as a substitute for all cases.

In a 640-ft. two-hinged arch, the writer has used 9000 lb. for 110 ft., followed by 7000 lb. as a substitute for E 70, which would correspond to 8350 lb. for 110 ft. for E 65.

The method saves a considerable amount of time in reading curved influence lines.

4. I wish to mention the computations for the actually occurring engine loadings on railroad bridges 10 to 20 years old, of which, on most railroads, there are some of long span and many of shorter span. The following practical questions have frequently to be answered by the bridge departments, with short time available to answer them: Can these bridges carry some new heavy engines in permanent service or in transfer to some other railroad? Can they carry them as single engines or as double-headers? Can they carry them followed by 4000, 5000 or 6000 lb. per lineal foot? Can they carry them with or without speed restrictions? In such cases a uniform load substitute for the engine and another for the tender will be found useful and time-saving, especially if influence lines have been drawn up for the bridges in question.

C. L. CHRISTENSEN,
Assistant Bridge Engineer, Niagara River Bridge,
Michigan Central Railroad Company.

Detroit, Mich.

More Light on Fair-Compensation Contracts

Sir—Your editorial in the issue of Dec. 26, 1918, p. 1156, relative to fair-compensation contracts, is very much to the point, and suggests the need for vigorous action to secure an equitable form of contract for public works practice. May I suggest that such action might well take the form of an editorial or article showing how the cost-plus contract should be drawn to guarantee the public interest, and that the rule of equity requires that equity must be done if it is to be invoked?

You state that this form of contract has demonstrated itself to the public. Then why, unless the demonstration has been unfavorable, has Congress legislated it out of existence? Why does one constantly hear that boys of 16 and 18 are hired as carpenters at fancy wages, that they are sometimes put to digging ditches, that they are encouraged to take Saturdays off and work Sundays at double pay, that everyone who ever asked for a raise got it, that men check in in the morning and then spend the day working somewhere else, and many similar tales, all to the benefit of the contractor's per cent.? There is a wide-spread belief that the cost-plus contract has enabled many contractors to get rich by deliberately increasing the cost of the job, and sometimes this belief rests upon facts personally known to those holding it.

Many of these things are petty, most of them can be explained by the emergency of war and are not the deliberate act of the contractor, but if this form of contract is to be restored to public favor their recurrence must be prevented by the terms of the contract itself, and the public convinced that such terms are in such contracts. Any other action by associated contractors will be regarded by the public as actuated by selfish, if not dishonest, motives and will fail to restore such contracts to public favor.

H. E. PHELPS,
Assistant Sanitary Engineer,
United States Public Health Service.

Petersburg, Va.

Repair Heaved Brick Pavement at Oak Park, Illinois

Sir—During 1917, three-quarters of a mile of brick pavement was laid at Oak Park, Ill. The specifications were drawn for the monolithic type. After ¼ mile had been laid according to this method, permission was given to lay the remainder according to standard specifications for the cement-sand-bed type. One-half mile of the latter type was laid in 1918. Expansion joints ⅝ in. wide were provided at the curbs, and a prepared

CONCRETE BASE CRUSHED AND BRICK LOOSENED FROM CEMENT-SAND BED BY HEAVE

asphalt filler was used. In the cement-sand-bed type, a 1-in. bed of 1:4 cement and torpedo sand was used.

During the winter of 1917-18, the monolithic pavement developed several longitudinal cracks, some of which were 150 to 200 ft. long. All of these cracks appeared on or near the center line of the pavement. Fine transverse cracks were noticeable in pavements of both types early last spring.

When the first warm weather came in the summer, the upheaval shown in the view occurred at the joint between a brick pavement of the cement-sand-bed type and an asphaltic concrete pavement on a 6-in. concrete base. The brick pavement which caused this "heave" was laid in the fall of 1917, average temperature about 40° F. The heave at this joint reached a maximum of about 5 in. above the normal surface of the pavement. Heavy

traffic was also destroying the grout filler between the bricks for a distance of about 2 ft. from the joint.

Investigation showed that the concrete beneath the asphaltic concrete pavement was pushed up and shattered by the expansion of the brick wearing surface. The grout-filled brick expanded independently of the base. It was found that the brick had pulled away from the base, and in some cases from the cement-sand bed.

No great difficulty was encountered in breaking through the concrete under the bituminous pavement, as the bond was completely destroyed. The concrete beneath the brick was found to be intact. The fact that the base under the bituminous pavement was destroyed, while that under the brick remained whole, may be explained by the fact that the subgrade beneath the asphaltic concrete pavement is 3 in. above that under the brick pavement. Because the brick pavement with its base was the stronger structure, the weaker one gave way.

The contractor who laid the brick pavement was instructed to make repairs as follows: (1) Remove the pavement and base on both sides of the joint, back as far as there was evidence of any disturbance; (2) instead of relaying the concrete base, lay a bituminous concrete base, similar to "closed binder"; (3) relay both brick and asphaltic wearing courses on this new foundation; (4) Fill spaces between bricks with some first-class bituminous paving filler.

After the experience of two seasons with brick pavements of the two types mentioned, we have decided to abandon both and specify an asphalt or pitch mastic bed and asphalt filler for all brick pavements on concrete base.

The writer cannot help but emphasize again the necessity of having a dry subgrade when paving foundations are laid, and the all-important need of providing real drainage beneath pavements. General paving practice does not consider the drainage question as it must be considered in order to have good pavements. It seems that any initial saving made by the present methods of construction is in reality false economy.

H. W. SKIDMORE,
Construction Engineer, Public Works Department.
Oak Park, Ill.

Further Tests on Time of Mixing Concrete

Sir—I was much interested in your editorial in the issue of Nov. 28, 1918, p. 966, under the heading "Minute Mix Justified by Extensive Tests." In that connection, I am handing you herewith the results of some experiments, which—although not extensive enough to be conclusive—point, I think, in the direction of the truth.

It was my privilege to be employed as engineer of tests on one of the large Government projects last summer, and I carried out, rather hastily, some experiments along this line, incidental to routine testing. The stimulus for my investigation was the "batch-a-minute" slogan of the manufacturers of which you speak, and a specification of one of our larger railroads which requires that "after all the ingredients are in the mixer the drum shall be given four complete revolutions before discharging."

There were in use on the job more than 50 mixers, representing all the well known makes. The aggregates in use were crushed limestone, river gravel, bank gravel, river sand, bank sand and limestone screenings. In connection with the routine testing, full notes were kept regarding the field conditions, the consistency of the concrete, the length of the period of mixing, the size and kind of mixer, and the proportions of the mixture. A wide variation was found in the compressive strength of the concrete, and when an attempt was made to group the results so that a study could be made of the effect of the time of mixing, no conclusions could be drawn because of the great diversity of elements in each group. It would be obviously unfair to compare, for instance, a sloppy concrete made with bank gravel and limestone screenings with a concrete of normal consistency, using crushed limestone and river sand as aggregate.

Accordingly, near the close of the work a series of experiments was undertaken, using the same aggregate in each of six different mixers, representing two distinct types. Particular care was exercised to secure the same consistency, as nearly as could be judged. There was no

TABLE SHOWING EFFECT OF TIME OF MIXING ON STRENGTH OF CONCRETE

Compressive Strength in Pounds at Seven Days, Average of Three 6-inch Cubes

Mixer No.	4 Turns	8 Turns	12 Turns	16 Turns
1	1080	1520	1340	1140
2	1280	1480	1030	1270
3	1600	1100		1080
4	850	1050	1120	1220
5	830	1050	1090	1090
6	1060	1090	1140	1190

Compressive Strength in Pounds at 14 Days, Average of Three 6-in. Cubes

	4 turns	8 turns	12 turns	16 turns
1	960	1650	1440	1360
2	1370	1630	1190	1320
3	1490	1490		1290
4	1100	1610	1610	1660
5	990	1140	1220	1250

Mixer No.	Size in Cu.Ft. of Unmixed Material	Revolutions per Minute of Mixer Drum
1	21	13
2	21	13
3	14	13½
4	17	14½
5	21	10½
6	14	14

means available for measuring the amount of water. Four batches were made with each mixer, one each at four turns, eight turns, 12 turns and 16 turns of the mixer. From each batch six 6-in. cubes were made, three of which were tested in seven days and three in 14 days. The specimens were stored in wet sand in the interval between making and testing. The results are summarized in the accompanying table.

As an explanation of the above reference to types, it may be said that mixers may be classified, according to the construction in the drum, into two well defined types: Those with buckets which carry the concrete up near to the top and then drop it, and those without buckets. In all of them the arrangement of vanes and buckets varies somewhat, but the bucket is the principal distinguishing feature.

Mixers 2, 3 and 6 are of one type, and 1, 4 and 5 are of the other, although No. 1 is on the borderland between the two, having some of the features of both. Attention is called to the results of the tests on mixers 2 and 3. Both produced better concrete at four turns and eight turns than at 12 turns and 16 turns. The

cause of this cannot be ascertained from the data at hand, but it is significant that such excellent concrete was produced in such a brief period of mixing.

I am of the opinion that the ability to produce good concrete in a brief period of time depends a good deal on the construction of the mixer. It is unwise to claim much on the evidence of a few experiments. Nevertheless, it seems to me that this point deserves the careful consideration of engineers and manufacturers, and more careful and more nearly complete experimental data.

University of Kansas, Lawrence. J. O. JONES.

What Is A Right-Hand Door?

Sir—There seems to be a difference in opinion as to the definition of right- and left-hand doors. Can you quote any authority which will settle the question?

The writer has always been guided by the following definition:

"The hand of a door is determined from the stop side. If the butts are on the right-hand side, it is a right-hand door. If the butts are on the left-hand side, it is a left-hand door." H. L. CONRAD,

South Bend, Ind. Engineer, H. G. Christman Co.

A Hint to Engineer Employers

Sir—Referring to "Positions Vacant": You might drop a hint to the Illinois Highway Department to the effect that if it needs civil engineers competent to make surveys, prepare plans and supervise construction, it will have to offer more than $100 to $140 per month. Trolley conductors and motormen get $5 and over per day, time and a half for overtime and double time for Sunday work. It takes about a week to qualify for a conductor or motorman, while an engineer has to spend four years in a college or university and about $3600.

Why *Engineering News-Record* should continue to publish such ridiculous advertisements is more than one can understand. Your editorial utterances and advertising columns do not seem to agree.

There are secretaries of our national engineering societies, engineering foundations and councils who draw salaries of $10,000 or more per annum—four or five times as much as the average civil engineer gets. They enjoy two or three months' vacation every year, and do nothing but write letters, reports and resolutions, which in the end amount to nothing. And we are fools enough to continue paying our dues. Can you explain it? M. AM. SOC. C. E.

Engineers and Draftsmen Are Organizing

Sir—Referring to the letter in your issue of Dec. 26, p. 1192, by A. F. Barnes, dean of engineering, State College of New Mexico, relative to the low salaries paid by the Government to engineers, and the necessity for an organization of engineers to promote economics, I take this means of informing Mr. Barnes and all other engineers that there is now in the course of formation a union of engineers and draftsmen, throughout the United States, which is affiliated with the American Federation of Labor.

It is the object of the organization to promote the general welfare of all engineers and draftsmen, and particularly those in the Government service, who have been shamefully neglected for many years past; even at this time they are compelled to make a desperate fight in order to put in effect the wage adjustment of the War Labor Board.

As stated by Mr. Barnes, the engineers and draftsmen have spent their every effort for the successful conclusion of the war, and in return have not received the slightest consideration from the Government. The other trades have forged ahead, raising their wages, bettering their working conditions through the influence of organization, but the engineers, mainly on account of lack of organization, have lagged behind. It is their intention, however, to make the influence of their organization felt, and for the information of any who may be interested, I solicit their correspondence.

This may be interesting information not only to Mr. Barnes but also to all engineers and draftsmen throughout the country. I know of no better means of putting it before them than through the columns of your paper.

R. N. ATHERTON, M. E.,
Vice President, Washington Society of Draftsmen.
Ordnance Department, Washington, D. C., Navy Yard.

I-Beams Retain Marks Thirty Years

Sir—The photograph here reproduced shows I-beams removed in November, 1918, from the Woodcliff reservoir, Woodcliff, N. J. These beams were used in the construction of bridges built by the County of Bergen approximately 25 or 30 years ago. They were abandoned when the area was converted into a storage reservoir by the Hackensack Water Co., in 1905. Since then

MARKS ON BEAMS VISIBLE AFTER THIRTY YEARS

there have been two occasions when the reservoir has been drawn down so that the I-beams were exposed; in one case for a period of about 30 days and in the second case about six weeks. Other than the two periods mentioned, the I-beams have been constantly under water. The beams were incased by brick arches, and when they were removed, it was noted that the paint was still on the surfaces of the beams where they had come in contact with the masonry. It was further noted that the white pointed figures, denoting lengths, were still visible in a great many cases. R. P. MCCLAYE,

Hackensack, N. J. County Engineer.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Single Air Header Supplies Eleven Drills

ONE 3-in. air hose was made to supply eleven drills, in shaft sinking, by feeding to the suspended metal "header" hung from a cable in the center of the shaft just above the bottom being drilled. Eleven 14-ft. hose lines led off from the bottom of the header. There was also one connection for a blowpipe. Eleven drills were operated and two drills were kept as spares. When all was in readiness for blasting, the header and hose were hoisted out of danger, and were lowered again when drilling was resumed. A round of 45 holes, averaging 8 ft., were drilled in 2½ to 3 hours. The 11 x 21-ft. shaft was sunk for the Seneca Mining Co., Mohawk, Mich.

Progress Chart for Recording Preparation of Construction Plans

THE progress of every drawing required for the construction work of the Detroit Edison Co. is recorded on 8½ x 11-in. cards of the type shown by the illustration. For small jobs, one card is used, but for larger jobs as many cards are made out as there are important divisions of the work. In the illustration, a number of drawings from different cards are entered, to show the variety of records possible.

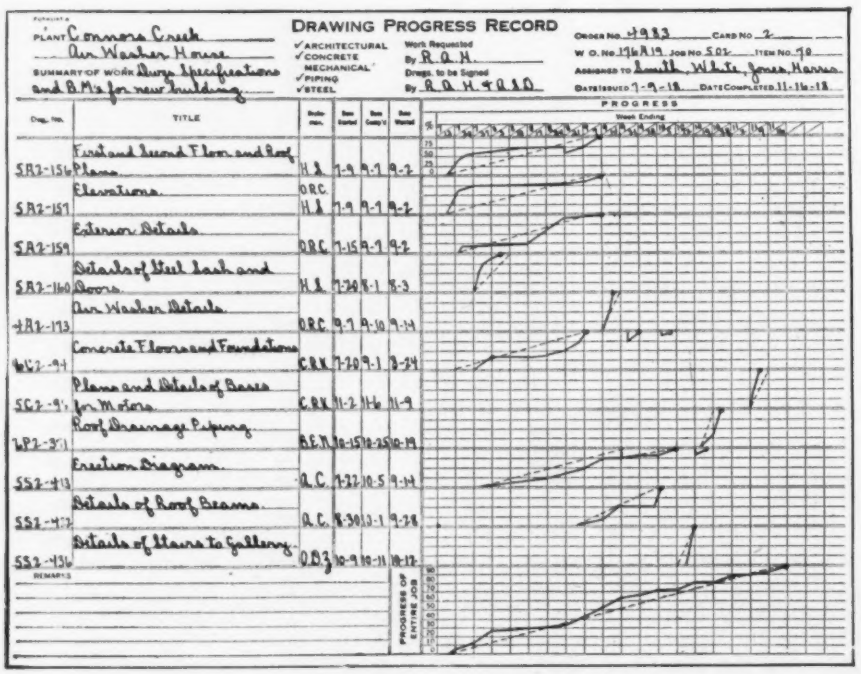
All the drawings to be made are entered on the card with the other information, as shown. The date on which each drawing is wanted is also shown, and a dotted line shows the progress that should be made to complete it in the required time. The actual progress made is shown by a full line for each drawing, while at the bottom of the card a curve on a larger vertical scale shows the progress for the entire job.

Watching these curves, one can readily see which drawings are progressing properly and which are being held up, for when a horizontal line appears it signifies that work has stopped. The reason is entered on the back of the card, where there is also a place to note all changes made that retard completion; also any information that is essential before the drawings can proceed is noted in a place for that purpose.

When a change is made, which is not an uncommon occurrence, the curve drops in proportion to the extent of the change. The back of the card also contains the order for the work in full and a list of all the bills of material, which are entered as they are completed. This is of great assistance in determining if everything has been ordered for the job. It can be seen that the card becomes a reference card after the office work is completed and its function as a progress record is done.

When the drawing is completed and leaves the drafting room, a circle is placed at the end of the curve, as shown. In case revisions are made after the drawing has been completed, they are indicated as shown for drawings "6 C 2 — 94" and "5 S 2 — 413." The drawings and the bills of material, upon leaving the drafting room, go to the estimating department for estimates and work orders. They then proceed to the office of the construction engineer for approval, after which they are sent to the order department, where materials are ordered and blueprints sent to the field or elsewhere, as the occasion demands.

It is necessary that each drawing be completed on time so that the material billed from the drawing will be on the job when it is needed. A glance at drawing "5 A 2 — 160" will show how this is done. The steel sash must be ordered many weeks before it is needed; therefore, when the plans and elevations are far enough advanced so that the number and size of the windows can be determined, the sash details are started and brought to completion as rapidly as possible. The direct opposite of this is shown by


DRAWING PROGRESS RECORD
PLANT Commerce Creek
Air Washer House
SUMMARY OF WORK Purch Specifications and B.M.'s for new building
✓ARCHITECTURAL
✓CONCRETE
MECHANICAL
✓PIPING
✓STEEL
Work Requested By R. A. H.
Drags. to be Signed By R. A. H. 9 R 1 D
Order No. 4933 Card No. 2
W. O. No. 196 A 19 Job No. 5.02 Item No. 70
Assigned to Smith, White, Jones, Harris
Date Issued 7-9-18 Date Completed 11-16-18
PROGRESS
Week Ending
Dwg. No.
TITLE
Date Rec'd
Date Cont'd
Date Cont'd
Date Wanted
SA2-156 First and Second Floor and Roof Plans H.L. 7-9 9-1 9-2
SA2-157 Elevations O.R.C. H.L. 7-9 9-1 9-2
SA2-159 Exterior Details O.R.C. 7-15 9-1 9-2
SA2-160 Details of Steel Sash and Doors H.L. 7-20 8-1 8-3
SA2-173 Air Washer Details O.R.C. 9-7 9-10 9-14
SC2-94 Concrete Floors and Foundations C.R.K. 7-20 9-1 8-24
SC2-95 Plans and Details of Bases for Motors C.R.K. 11-2 11-6 11-9
SP2-311 Roof Drainage Piping R.E.N. 10-15 10-25 10-19
SS2-413 Erection Diagram R.C. 7-27 10-5 9-14
SS2-417 Details of Roof Beams R.C. 8-30 10-1 9-28
SS2-436 Details of Stairs to Gallery O.B.J. 10-9 10-11 10-12
REMARKS
PROGRESS OF ENTIRE JOB

PROGRESS CHART SHOWS STATUS OF EACH CONSTRUCTION DRAWING

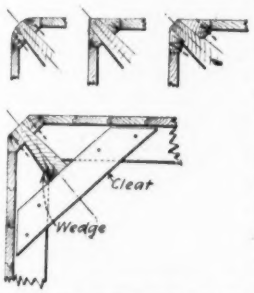
drawing "5 C 2 — 96." These bases were not needed until the building was well under way, so nothing was done on the drawing until the other drawings were completed.

This method of recording progress of drawings is described by J. C. Thornton in the *Synchroscope* for January, 1919.

Formwork Easily Stripped by Use of Special Corner Detail

By L. Kopczynski
Wilmington, N. C.

THERE has always been some trouble in stripping of forms in reinforced-concrete work, especially in angles which become wedged tightly. The sketch is self-explanatory. All the pieces are milled; no hand-work fitting is necessary. Using a gage for holding the corner, it can easily be assembled by one man, and the forms will be made rigid and strong by nailing the corner cleat, if possible, with double-headed nails. The removal of this cleat will allow the wedge to be driven out, and the forms are easily stripped. This appliance is called "Kop's Corner," and I would be pleased if the contractors would introduce it in their work by that name, as it is cheap and no royalty is involved. It saves material and labor—also the religion of the strippers. The corner can be elaborated, made as shown in the sketch, or rounded off, or given any form desired.



CORNER DETAILS MAKE STRIPPING EASY

Ample Clearance on Scaffold Runways Saves Working Time

MAKING scaffold runways around the hull of ample width is an important detail in good shipyard management, says a shipbuilder who had occasion to work in various shipyards last summer. The runways should be wide enough to let the men passing along clear the men working on the side of the ship. In one or two yards the walks are so narrow that men coming up the stairways and going along a runway are bound to interfere with the work of reaming and riveting gangs. Such an encounter means that both parties lose time. In addition to the waste of labor expense, the progress of the ship is delayed, which means a distinct additional expense item.

At one yard the rule was made, in the initial design of the scaffolding and the layout of berth space to accommodate it, to provide for three 10-in. planks as minimum runway width on the overhang of the scaffold ledges. This is by no means ample provision, says the shipbuilder, but it is vastly better than an arrangement that provides for only two planks.

In details of this kind it is easy to lose a large part of the gain in working efficiency secured through well studied plant layout and good equipment. Failure to provide proper runway capacity can only be attributed to lack of care, because there is no advantage in compactness of scaffolding in itself.

Caisson Chambers Concreted in Sections

ASSURANCE that the concrete seal would fill closely all corners was sought by concreting the working chambers of the large pneumatic caissons of the Metropolis bridge in four sections.

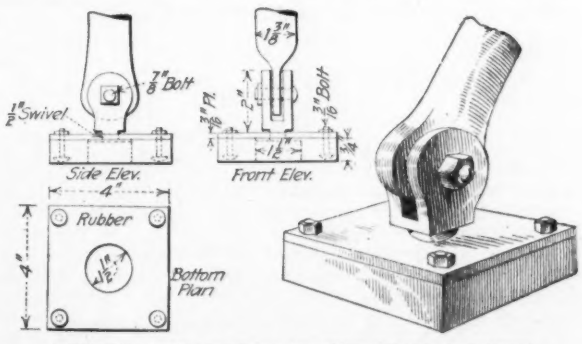
These caisson chambers varied in size from 80 x 47 ft. to 110 x 60 ft. Ordinarily, in filling such chambers there is a doubt whether the concrete has penetrated to the farthest corners of the caissons, after they have been filled to such an extent that men cannot work in them. To relieve this doubt at Metropolis, bulkheads were built across the working chambers so as to divide them into four sections each. The two end sections were concreted first. Then holes were bored through the bulkheads to determine whether at any point cavities existed in the concrete filling. One of the middle sections was then concreted and tested for solidity.

Finally, the last section was concreted. This section could not, of course, be tested as were the others, but its small size decreased the chances that the concrete would not flow to all parts.

According to G. A. Haggander, bridge engineer of the Chicago, Burlington & Quincy R.R., the sectional method of sealing the caissons probably presented no construction advantage such as reducing cost of plant or amount of labor, but it did enable the engineers to ascertain with certainty whether the chamber had been solidly concreted.

Safety Feet for Ladders Made With Rubber Pump Valves

LADDERS to be used on concrete or metal floors can be made safe from slipping by fitting them with rubber feet, as indicated by the accompanying sketches. In this particular case soft rubber pump valves were utilized, but any flat pieces of soft rubber about ¾ in. thick will serve as well. The rubber is fastened, with countersunk bolts, to steel plates fitted with swivel connections for the ladder feet. A hole in the center of this rubber shoe acts as a vacuum cup, sealing the shoe to wet floors. W. H. MacMahon, safety inspector, Republic Iron & Steel Co., Gilbert, Minn., describes this device in *Engineering and Mining Journal.*



RUBBER FEET KEEP LADDERS FROM SLIPPING

NEWS OF THE WEEK

New York, January 23, 1919

Committee to Revise Federal Shipbuilding Program

Five Shipping Men and Two Officials from Fleet Corporation to Examine Present Plans

The United States Shipping Board has announced the personnel of the committee to examine the building plans of the Emergency Fleet Corporation, with a view to such revision as might be wise in view of the altered international situation.

This committee is to consist of J. A. Farrell, president of the United States Steel Corporation; P. A. S. Franklin, president of the International Mercantile Marine Co.; George S. Dearborn, president of the American-Hawaiian Steamship Co.; H. H. Raymond, president and general manager of the Mallory Steamship Co., and F. D. M. Strachan, president of Strachan Shipping Corporation. In addition to the foregoing, Charles Piez, director general of the Emergency Fleet Corporation, and John H. Rosseter, director of operations of the United States Shipping Board, will be ex officio members of the committee. Of these, Mr. Dearborn and Mr. Raymond are the nominees of the American Steamship Association, which was asked to designate two of its members for places on the committee.

New Questions Arising

Until hositilities ceased the purpose and effort of the Fleet Corporation was to produce useful tonnage in the largest possible quantity to keep pace with the growing need of tonnage as our overseas forces increased, and to repair the destruction wrought by submarines. With the signing of the armistice, the problem of the Fleet Corporation took on a different aspect, and the question now is, "What revisions of type are advisable and what modifications of plan or practice can be undertaken to give the Fleet Corporation's output of ships as high an economic value in world trade as possible?"

The lifting of the pressure, both of need and time, which controlled the Fleet Corporation's decisions during the actual continuance of war, makes it possible to give more consideration to economic standards, and the Director General and the other officials of the Fleet Corporation have for many weeks been engaged in a thorough examination of the corporation's building plans, and have themselves developed some important suggestions. It is to test these proposed alterations of program that the committee above named has been appointed.

For the convenience of engineers returning from military life, and others, there are listed below agencies which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau; Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service; A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service; George W. Kirchwey, state director, 16 East 42nd St., New York City.

Bill Provides for Federal Public Works

Senator Kenyon, of Iowa, chairman of the Senate committee to investigate labor conditions, has introduced a bill appropriating $100,000,000 for expenditure on public works. It would create an agency known as the United States Emergency Public Works Board to supervise expenditure of the fund and to have general charge of Federal, state and municipal developments to check unemployment.

Besides the $100,000,000 emergency fund Senator Kenyon proposes to authorize advances by the War Finance Corporation to the extent of $300,000,000, upon approval of the Federal board, for public works certified to be necessary by the Secretary of Labor to prevent unemployment.

Kansas Good Roads Association Favors $60,000,000 Bond Issue

At a recent meeting in Topeka the Kansas Good Roads Association started a campaign to have the coming legislature submit a constitutional amendment at the next election that will permit the state to aid in good roads construction, and also to submit a bond issue for $60,000,000 to provide for this aid.

A system of 5000 miles of hard-surface highways, which will connect every county seat and market center in the state, is planned. To help finance the system, it is proposed to change the motor-car registration and license law, from one based upon a flat fee of $5 per year, to one based on the horsepower of the car, the revenue to be utilized to pay the interest and principal.

Tariff Commission Favors Free Zones

Urges Immediate Congressional Action Permitting Their Creation, To Foster Foreign Trade

Free ports or zones should be permitted in the United States, in the opinion of the United States Tariff Commission, which has just made an exhaustive report on the subject to the Committee on Commerce of the United States Senate. The legislation which it recommends—a revision, in part, of two bills now before Congress—is merely permissive in character. It leaves the initiative to the locality and puts upon it all risks and responsibilities. Each state or political subdivision thereof is permitted to establish and equip at its own expense a zone wherein foreign merchandise may be entered free of duty.

As defined by the report, a free zone is "an isolated, inclosed and policed area in or adjacent to a port of entry, without resident population, furnished with the necessary facilities for lading and unlading, for supplying fuel and ship stores, for storing goods and for reshipping them by land and water; an area within which goods may be landed, stored, mixed, blended, repacked, manufactured, and reshipped without payment of duty and without the intervention of customs officials. It is subject equally with adjacent regions to all the laws relating to public health, vessel inspection, postal service, labor conditions, immigration, and, indeed, everything except the customs." The purpose of the free zone is to encourage and expedite that part of a nation's foreign trade which its Government wishes to free from the restrictions necessitated by customs duties. It aims to foster the dealing in foreign goods that are imported, not for domestic consumption but for reëxport to foreign markets and for conditioning or for combining with domestic products previous to export.

At present the only provisions to take care of such reëxporting lie in the bonded warehouse, the bonded manufacturing warehouse and the drawback system. None of these, in the opinion of the commission, is adequate to foster the foreign reëxport trade which is now necessary to this country. All three are cumbersome in their operation and limited in their application. In the opinion of the commission, the business proper to a free zone consists in receiving and manipulating the foreign products and reshipping them in the direction and at the time to take advantage of the best foreign markets. This is not only a profitable business, but is also becoming

a necessary business in our industrial growth, for, however wide the range of goods we produce and however effective our methods of production, we can sell our products to best advantage only when the purchasers are able to pay for them with products of their own. If we do not accept their products they must sell them in some third country and transfer to us the credits that they thus acquire — unless, indeed, they forego buying our goods at all and make their purchases in the country where they make their sales.

Transshipment trade in the United States has been steadily declining since the banner days of American shipping, but the present conditions are very favorable to its revival. In the opinion of the commission, however, the burden of the free port or zone must lie upon the locality which desires it, and the only function of the Federal Government is to provide laws whereby the zone may be operated.

The report details under the following heads the advantages to be expected from the free zone system: The simplification of entry and clearance, the equalization of the inbound and outbound traffic, the facilitation of dealings in foreign products, the stimulation of certain branches of manufacturing and the stabilization of transshipment trade under varying tariff policies. The commission feels sure, after a lengthy study of the theory of the subject—amplified by hearings in many of the ports of the country and the study of the answers to questionnaires sent out to merchants and shippers—that the time is now ripe for the development in the United States of this type of port, which has already proved successful in several European cities, notably Copenhagen, and Hamburg.

Engineering Council Acts on Public Service Engineers' Discharge

Following the hearing held last week on the dismissal of over 300 engineers of the Public Service Commission of New York City, as reported in *Engineering News-Record* of Jan. 16, p. 163, the Engineering Council Jan. 16 adopted a resolution urging the Board of Estimate and Apportionment of the city to reconsider its action. The resolution is based on a statement of findings in which it is asserted that the city's rapid-transit construction work will be seriously hampered and delayed by the disruption of a highly specialized trained organization built up to carry on this work; that the dismissal of 339 men of the engineering force by effect of the "line budget" adopted by the Board of Estimate Dec. 30 was an injustice of which no employer should be guilty; that the alarm of the laboring men employed on subway work over the curtailment of proper engineering inspection and supervision is justified and should be heeded; that the Board of Estimate's action will result in the discharge of a considerable body of labor and will prevent the employment of additional labor for the sections for which contracts were to have been let, which action is contrary to economic wisdom; that large loss to New York City is threatened through claims for delay which will arise from the disruption of the engineering force; and that the noncompletion of certain subway sections, preventing operation of trains in other sections, involves a striking waste of public funds. On this showing the action described below was taken:

"In view of the above facts, Engineering Council, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, having a membership of over 36,000, which body is vitally interested in engineering and is qualified to speak in matters involving the satisfactory direction of engineering work, hereby adopts the following resolution:

"Resolved, that in view of the above facts, the Board of Estimate and Apportionment be urged to reconsider at once its action of Dec. 30 and to make such appropriation as will enable the Public Service Commission to carry on with safety and economy the rapid completion of the subway work, and that the Board of Estimate should leave to the Public Service Commission, on which the law places the responsibility, the detailed apportionment of these funds in accordance with a practical schedule to be prepared by it and submitted to the Board of Estimate for its information."

Little Government Surplus of Building Material

Conference Called By War Industries Board Shows That Excess Material Can Be Absorbed Readily

At a conference called by Richard L. Humphrey, director of building materials, War Industries Board, at Washington last week, it was announced that little trouble was anticipated in disposing of the Government's surplus stock of building materials. At the conference were represented the various Government agencies which had been purchasing and using building materials, and representatives of the building material War Service Committees.

The subject of the disposal of surplus stock was thoroughly discussed, and the following facts were developed:

1. That the Government agencies are not going to dispose of surplus stocks of building materials in such a way as to disturb market conditions.

2. That these surplus stocks are being rapidly absorbed by redistribution among the several Government departments so that the greater portion of these materials will be thus cared for.

3. That, with the exception of lumber, the amount of these surplus stocks is very small, and cannot materially affect market conditions.

4. That the largest single material was lumber, and in connection with it a plan was unanimously agreed to, and is now being considered by the industry, whereby the Government will in a suitable manner dispose of amounts too small to affect the market in any way; where large amounts are concentrated the disposal will be made in conjunction with the industry. It is estimated that the total amount of this surplus stock does not constitute more than one-sixth of the normal monthly output of lumber for the entire country. The same plan is to be applied to other building materials, and is being considered by these industries.

Estimates of the amount of building materials the Government has on hand are given below. Accuracy in the estimates is not possible, but there is reason to believe the figures do not contain an error larger than 25 per cent.:

Commodity	Quantity
Brick	14,516,000
Hollow tile	2,235,403 pc.
Lumber ft. b. m., veneers and plywood	350,000,000
Cement	115,523 bbl.
Lime	77,560 bbl.
Flue linings, lin.ft.	29,226
Metal Lath, sq.ft.	1,122,313
Wood Lath	2,695,000
Wallboard (all kinds)	5,406,429
Roofing, rolls	202,208
Building Papers, rolls	52,377
Nails, assorted sizes	159,622 kegs
Reinforcing steel	3,000 tons
Sewer pipe, assorted sizes, lin.ft.	577,407
Wood shingles	908,000

Indiana Highway Commission Law Declared Constitutional

After several months of litigation, the State Highway Commission of Indiana and the statute under which it operates have been declared constitutional by the State Supreme Court. This will allow extensive highway improvements, which had been held up pending the decision, to go forward.

The decision was rendered in a taxpayer's suit instituted by Robert M. House of Hamilton County, who averred through his attorney that the law in its operation would be confiscatory, in that it took money from him without giving him a return equal to that given to taxpayers living on the road or nearer it than he. It was claimed that this is contrary to the 14th amendment of the Constitution of the United States, which prohibits taking property without due process of law.

It was argued that the statute was void in that it created offices and provided for the expenditure of money not specifically authorized by the state constitution. A lower court sustained these contentions and declared the law unconstitutional, as reported in *Engineering News-Record* of May 16 ,1918, p. 976. Editorial comment upon the action of the state Supreme Court in taking a three months' vacation, further delaying a decision on appeal, will be found in *Engineering News-Record* of July 18, p. 109.

The state Supreme Court has finally overruled the lower court, and, as a result of this decision, it is proposed

to start immediately construction on approximately 120 miles of main market highway, from Indianapolis to South Bend, which is estimated to cost $3,000,000.

It is further asserted that the decision upholds the validity of acts creating other state offices, and in general indicates that the Indiana constitution is a guaranteeing rather than a limiting instrument.

Ohio Good Roads Congress in Joint Sessions

The second annual joint convention of the Ohio Good Roads Federation, the Ohio Engineering Society and the County Commissioners' Association of Ohio held in Columbus, Ohio, Jan. 14-16, developed a variety of topics, but the central theme of all discussions was, "Get Ohio out of the mud."

The first session of the Ohio Engineering Society was addressed by Pres. Thomas J. Smull, who reviewed the work of the society for the past year and made recommendations for the present year. Among them was the further improvement of the service bureau inaugurated by Sec. John Laylin, and the desirability of final action upon the question of licensing engineers. C. E. Drayer, of Chicago, discussed "Licensing Engineers," and as stated elsewhere a resolution favoring licensing was passed unanimously.

Other speakers of the week on subjects of special interest were: "Recent Military Achievements with Concrete," by A. J. R. Curtiss, Portland Cement Association, Chicago; "Federal Highways," by H. S. Shirley, secretary of the Highway Industries Association, Washington, D. C.; "Road Improvements in Ashtabula County," by Ray Case, county engineer of Ashtabula County, Ohio; "Military Engineering with the American Expeditionary Force in France," by Capt. J. F. Mollenkopf, Van Wert, Ohio; "Report of Codifying Commission, Ohio Drainage Laws," by P. T. Ford, secretary of the commission, Ottawa, Ohio; "Public Utilities," by the Hon. Beecher W. Waltermire, of the Ohio Public Utilities Commission, Columbus, Ohio; "Production and Uses of Asphalt," by William Howe, Texas Co., Chicago.

The following officers of the Ohio Engineering Society were elected: President, Ett S. Smith, Youngstown; vice-president, Cecil L. Rood, Toledo; secretary-treasurer, John Laylin, Norwalk.

Akron Will Vote on $3,000,000 Sewerage Bonds

The city council of Akron, Ohio, has passed a resolution to submit to the voters Mar. 4 a proposed bond issue of $3,000,000 for the construction of trunk sewers and to pay the city's part of the cost of other sewerage work. This is part of a sewerage program estimated to cost $6,000,000, exclusive of the cost of sewage treatment. H. S. Morse is director of public service.

National Service Committee in Washington Office

Engineering Council Establishes Service for Engineers—Names of Members Announced

In order more completely to provide for united action upon matters of common concern to engineers, the Engineering Council has recently organized a National Service Committee and has established an office in the national capital. This action was based upon a tentative plan for representation of engineers at Washington, submitted to the council at a special meeting on Nov. 21, 1918, by Philip N. Moore, of the American Institute of Mining Engineers. (See the December *Proceedings* of the American Society of Civil Engineers.) The present member societies of the Engineering Council are the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the United Engineering Society and the American Society for Testing Materials.

The Engineering Council, through this National Service Committee and its Washington office, intends to accomplish the following general purposes, this committee acting always under the direction of the council and within limitations fixed for it:

1. To discover public services which may best be performed by engineering societies, and, when desired, to offer the proper men for such services.

2. To speak authoritatively for the Engineering Council before committees of Congress and departments of the Government on all public questions of common interest to engineers, within such limitations as the council may set from time to time.

3. To give promptly wide circulation among engineers to authentic information regarding pending legislation and executive actions which may affect the interests of engineers in any way.

4. To gather opinions of engineers on these matters.

The Engineering Council's aim is disinterested usefulness to the nation and the profession—not advocacy of any selfish ends—by giving unbiased information and counsel on technical matters, chiefly when asked. A modest start is being made. The work will be enlarged only as a real demand for services develops.

The members of the National Service Committee have been chosen so as to represent different parts of the country. The appointees are the following: Chairman, M. O Leighton, M. Am. Soc. C. E., Washington, D. C.; C. B. Burdick, M. Am. Soc. C. E., Chicago, Ill.; George F. Swain, M. Am. Soc. C. E., Boston, Mass.; Philip N. Moore, M. A. I. M. E., St. Louis, Mo.; L. D. Ricketts, M. A. I. M. E., Warren, Arizona; Andrew M. Hunt, M. Am. Soc. M. E., San Francisco and New York; Andrew M. Lockett, M. Am. Soc. M. E., New Orleans, La.; W. C. L. Elgin, M. A. I. E. E., Philadelphia, Penn.; Bancroft Gherardi, M. A. I. E. E., New York.

The Washington office is located at 502 McLachlen Building, 10th and G Streets.

To Ask $500,000,000 for New Railroad Improvements

Director General Walker D. Hines announced Jan. 15 that the Railroad Administration is preparing to ask Congress for another revolving fund of $500,000,000 to be used in financing the program of railroad improvement that is now being planned by the Government. This program calls for a total of authorized capital expenditures for the years 1918 and 1919 of $1,627,000,000, and the Director General estimates that the minimum additional amount in the budget for 1919 must be $350,000,000. The new fund would bring the total appropriated by Congress for the Railroad Administration up to $1,000,000,000.

The Director General states that it is to be understood that none of this fund is to used to pay the deficit of nearly $200,000,000 incurred by the war emergency operation of the railroads in 1918. He distinguishes two functions of the Railroad Administration under Federal control: (1) To render public service through operation of the railroads, collecting of the revenues therefor, and paying the expenses and the rental due the railroad companies. The other function is to require that necessary permanent improvements be made, including purchases of new equipment. He believes that the carrying out of the second function may call for the temporary use of a great deal more Government money than is needed for the first.

American Railway Association Is Reorganized

The Director General of Railroads announces that during the period of Federal control, in order to provide a responsible channel through which he may obtain recommendations for the advancement of railroad practice, the American Railway Association will change its name to the American Railroad Association. Its scope has been enlarged and will cover the former activities of the following organizations: The American Railway Association; American Railway Master Mechanics' Association; Association of Railway Telegraph Superintendents; Association of Transportation and Car-Accounting Officers; Freight Claim Association; Master Car Builders' Association; Railway Signal Association; and Railway Storekeepers' Association.

The new organization will consist of five sections: 1, Operating; 2, engineering; 3, mechanical; 4, traffic, and 5, transportation. Railroads under Federal control are members of the association and are directed to appoint representatives and participate in the activities of the association through their proper officers.

Honor Achievements of Construction Division

Brilliant Dinner at Washington to General Marshall and Officers Marked by High Enthusiasm

To celebrate fittingly the construction achievements of the Army in this country during the war, Brig.-Gen. R. C. Marshall, Jr., and the officers of the Construction Division were entertained at a dinner by their friends at the New Willard Hotel, Washington, last Friday night. Four hundred and thirty persons were present, half of them being officers and the others the hosts of the evening. An elaborate program had been prepared, consisting of vaudeville acts and a sketch, written and acted by officers of the division, hitting off the little failings of their prominent brother officers and making good-natured fun of incidents and practices in the work of the division. The evening was notable for the remarkable enthusiasm and spirit of fellowship which prevailed throughout the evening, experienced diners-out declaring it one of the most successful of big Washington dinners.

The reason for the celebration was well expressed by Assistant Secretary of War Benedict Crowell when he declared that the Construction Division "had done a 100% job." The toastmaster, E. J. Mehren, editor of *Engineering News-Record*, paid high tribute to General Marshall and the officers of the division, declaring their work to be the greatest construction achievement under a single organization in the history of the world. He commended the vision displayed in outlining the policy of the division, and attributed the success of the work to the high character of the personnel, to the decentralization of authority, and to the spirit of fair dealing with contractors, manufacturers and labor which characterized the work of the division.

General Marshall, in acknowledging the tribute of the toastmaster, gave the credit for the Construction Division's work to the officers and men of his organization. He also gave full credit to the work of the manufacturers, declaring that those who stayed behind and produced supplies were the "unsung heroes of the war."

Tribute to the Construction Division

Mr. Mehren spoke in part as follows:

"In a general way we know what the Construction Division has done, but a few figures will serve to impress on us the magnitude of the task. It built in 90 days 16 soldier cities, each for a population of 40,000 (now increased to about 50,000), with all the utilities, such as water, sewerage, electric power and fire protection, that a modern city requires. This feat remains still the greatest single achievement of our war preparations. We had to have the cantonments quickly. We unloaded this unprecedented job on the Construction Division and they came back in 90 days with the job done.

"The work done by the division will total about $800,000,000 in cost, and of that huge sum $400,000,000 was spent in a period of 15 months, a record for construction under a single organization that has never been approximated in the history of the world.

"Needless to say, the accomplishment of such a huge task economically and efficiently and at the same time at top speed required an extraordinary organization and exceptional vision and administrative ability at the top. The organization drew to itself the best brains of the country in the field of construction, and those in charge wisely gave full authority to the men in the field.

"With this type of personnel, and this broad-gaged delegation of authority from Washington, went a policy, handed down from the top, of fair dealing with the various contracting and manufacturing organizations selected to do the work and supply the materials. The Construction Division has done more in its brief life to establish a fair contract for Government work than have the contractors themselves in a whole generation. The cost-plus-limited-fee contract, as applied by the Construction Division, guaranteed justice to the Government and the contractor alike, and when that contract was challenged in the general criticism of cost-plus contracts, a board composed of the presidents of the leading engineering societies of the country studied the contract, and approved it in the very highest terms.

The Division's Labor Record

"Further evidence of the spirit of cooperation and fair play that characterized the work of the division is shown by its extraordinary labor record. Though during its operations its contractors employed 400,000 men, the labor troubles were negligible, all of them being handled by a staff of five, some of whom had other duties besides.

"Never has a body of engineers and constructors been called on to do so tremendous a job. Never were the conditions more unfavorable for success. The material that was in hand had to be used, rather than that which was most suited to the work, transportation facilities were terribly congested, labor was frequently inefficient. With these bad conditions were combined the enormous size of the job and the terrific speed with which every part of it had to be put through. Had there been in waiting a fully prepared organization, composed of trained men who had long worked together, the job would have been hard enough. But there was no organization. Thirty men constituted the available force in April, 1917. In a few months, however, the big job was running smoothly. By selecting the ablest construction men the country afforded, and uniting them under an intelligent, open-minded leadership, it has been possible not merely to master the job, but to do it with a brilliance that has attracted attention throughout the country.

"It is fitting, therefore, that those who have seen the organization at close range, and watched it expand from the original band of 30 to a smoothly functioning organization of 6000, should join in a public tribute to those who have written the name of the Construction Division so brilliantly not only into the history of the war, but into the engineering and construction annals of this country."

General Marshall's Reply

General Marshall paid tribute to his officers and the manufacturers, in the following words:

"In all modesty, I now distribute to the members of the Construction Division here tonight all of the kind words and the thoughts they express, which have just been uttered. Theirs the credit, and to them must it be given. Such statements as have just been made prove embarrassing to me, for to the success of this war there have been many contributors.

"Homeward the boys come—and to each shipload that lands at our ports there goes forth the gratitude of a nation. In pictures, in poetry, and in song are their valorous deeds portrayed. It is their just due. I do not in the least detract from the value of their bravery when I tell you of another hero.

"The unsung hero of this war is the man who remained behind, and, in the intensity of his devotion, to the very commonplace occupation of producing supplies for our Army gave his utmost to the Great Cause. He it is whose constant efforts made possible the victorious onslaught of the man whose privilege it was to face the enemy. In and out of uniform, on this side of the ocean, an entire nation contributed to its utmost capacity.

"The incessant booming of the guns on the Hindenburg line was only the echo of the constant whir of machinery on the manufacturers' line. The shout and battle-cry of our brave ones overseas was the reverberation of the order to workers on this side to produce. The camp-fires of France were kept brightly burning by the furnaces of America.

"From the very inception of our participation in this world war, the unanimous response of the man in business spelled 'Victory.' His loom, his lathe, his furnace—yes, his every energy—turned the profitable output of commercial products into the production of whatever form of munitions and supplies was asked for by the Government. From his door belched forth the contributions of an earnestly patriotic effort to wrest victory from a common enemy.

"To this American, represented by our hosts tonight, I lay the tribute of the Construction Division in gratitude for the help he has been in accomplishing the task given us to perform."

Brief Biographies of Engineers Who Handled War Construction Work in America

Men Who Have Had the Handling of $800,000,000 Worth of Buildings, From Cantonments to Huge Terminal Warehouses

Biographical sketches of the leaders in the Construction Division of the United States Army who have been handling over 300 projects in Army construction in this country, totaling $800,000,000 and ranging from cantonments — miniature cities in themselves — up to the $40,000,000 terminal supply base and warehouses in Brooklyn are here recorded to indicate the type of men who have successfully carried through one of the greatest construction activities of history. This work required at one time 300,000 men, and included camps, cantonments, arsenals, wharves, docks, forts, great port terminals, reserve storage warehouses, hospitals of all sizes and descriptions, aviation fields, proving grounds, embarkation camps, engineers' camps, gunnery schools, housing, lighterage, power plants, factories, additions to manufacturing plants, munitions works, and special new plants for the production of nitrates, phosphorus, etc.

Brigadier General R. C. Marshall, Jr.

America's Army cantonments stand as a monument to the energy and resourcefulness of Brig. Gen. Richard C. Marshall, Jr., chief of the Construction Division, a native of Virginia. As Colonel Marshall he undertook with Col. Isaac W. Littell the organization of the Cantonment Division of the Quartermaster Corps of the National Army in May, 1917. So successfully was this work prosecuted that mushroom cities on 32 sites were soon completed.

General Marshall was born in Portsmouth, Va., in 1879, and was graduated from the Virginia Military Institute in 1899. He was appointed captain in the Fourth United States Infantry on June 29 of that year, and honorably mustered out of service after having served through the Cuban campaign. In 1901 he was appointed second lieutenant in the Artillery Corps. He was an honor graduate at Fort Monroe, Virginia, class of 1904, was promoted to a lieutenancy in January, 1904, and in December, 1907, was made captain. In June he was detailed to the Quartermaster Corps, and served in the construction and repair branch until the beginning of the 1917 emergency.

When the cantonment construction was finished, all construction work of the Army was turned over to the Cantonment Division, on account of its excellent work, and it was made a separate corps, known as the Construction Division of the Army. Colonel Marshall, then a major, was made lieutenant colonel and placed in charge, and in March, 1918, he was promoted to a colonelcy. He became brigadier general in July, 1918.

Colonel Gunby—Engineering Division

Formerly a partner in the firm of Charles T. Main, of Boston, Col. F. M. Gunby, in charge of the Engineering Division, was called to Washington in May, 1917, to take charge of the engineering for the construction of the cantonments. An important part of his work has been done in connection with obtaining appropriations from Congress and the handling of funds and authorizations for the work of the Construction Division. He was graduated from Clemson Agricultural and Mechanical College, Clemson, S. C., in 1902. In April, 1913, he enlisted in Company G, Fourth Infantry, Georgia State Troops, and was discharged as first lieutenant in May, 1905.

He enlisted in Company C, First Corps Cadets, Massachusetts Volunteer Militia, in May, 1908, and was discharged in December, 1911. He was commissioned major in the Quartermaster Corps in 1917, made lieutenant colonel in February, 1918, and commissioned as colonel in March, 1918.

Colonel Bush—Engineering Division

Col. Lincoln Bush, assistant to chief of the Engineering Division, was born in Orland, Ill., in 186[illegible]. He was graduated from the Cook County Normal School in 1881 and from the University of Illinois in 1888. Before entering the service he had been division engineer of the Chicago & Northwestern Ry., Chicago, bridge engineer, and then chief engineer of the Delaware, Lackawanna & Western R.R.; consulting engineer, vice-president and treasurer of Flickwir & Bush, Inc., New York City. As consulting and contracting engineer he has been engaged in bridge work, foundation work, steam-shovel work, tunnels and subway construction, and is the inventor of the well known Bush trainshed.

Since joining the Construction Division he has designed terminal ports, warehouses, some ordnance projects, miscellaneous engineering works, etc., has given advice relating to field execution, and has acted as representative on projects designed and constructed for storage and port terminals, harmonizing to some extent the work done by employees within the Construction Division and other branches of the Army service.

Colonel Shelby—Contracts Division

Colonel Evan Shelby, chief of the Contracts Division, was admitted to the bar of New York in 1896. He practiced law from 1898 to 1906, when he formed a partnership with R. C. Taylor. Since 1912 he has practiced alone, and for four years was New York attorney for the Panama Railroad. He is a member of the Bar Association of the City of New York. He was born in Fayette County, Kentucky, in 1872, was graduated from Kentucky University in 1893, and obtained the degree of LL.B. from the University of the State of New York in 1896.

Upon his entry into the service he was made legal adviser to the Cantonment Division, and was made chief of the Contracts Division in June, 1917. He has had charge of drafting contracts and bonds and also all matters relating to insurance, fire casualties and workmen's compensation.

Colonel Willcutt—Materials Division

Col. Joseph N. Willcutt, chief of the Procurement Division, was born in Cohasset, Mass., in 1875, and was graduated from Harvard University in 1898. Before becoming an Army officer he had been in the construction business, with offices in Boston, doing construction and engineering work. He entered the Army service during the Spanish war in 1898, in the Quartermaster Corps, and during the Texas mobilization for protection against Mexico was camp quartermaster, with the rank of major. He held that rank when he entered the United States service in July, 1917.

Since becoming connected with the Construction Division he has been assistant to Colonel Whitson, in charge of construction of the National Guard camps, and after eight months was put in charge of the Procurement or Materials Division of the Army.

When he joined the division he was president of the L. D. Willcutt & Sons Co. of Boston, Mass.

Colonel Junkersfeld—Building Division

Col. Peter Junkersfeld, chief of the Building Division, before entering the service was, successively, assistant mechanical engineer, electrical engineer, and assistant vice president of the Commonwealth Edison Co., Chicago. He was president of the Association of Edison Companies, with supervision of, or doing consultant work in, contracting, engineering, construction and operation, including allied interests having electric, gas, railway, heating, ice-making, and other utility properties in several states. Colonel Junkersfeld was born in Sadorus, Ill., in 1869, and was graduated from the University of Illinois in 1895, taking the degree of electrical engineer at that university in 1907.

Since joining the division he has been associate officer in charge of the Building Division, obtaining requirements, authorizations, and funds for projects, directing the constructing forces in the field and advising on the commercial relations of the Construction Division.

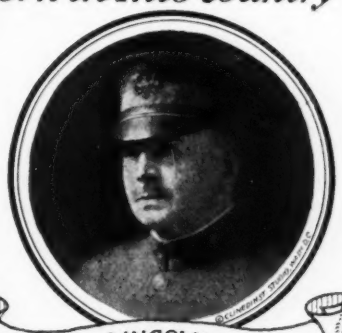
(*Concluded on page* 210)

LEADERS *of the* CONSTRUCTION DIVISION *of the* UNITED STATES ARMY

Handling $800,000,000 Worth of Work in This Country

COL. F. M. GUNBY

IN CHARGE OF THE ENGINEERING DIVISION



COL. LINCOLN BUSH

COL. JOSEPH N. WILLCUTT
IN CHARGE OF THE MATERIALS DIVISION

BRIG. GEN. R. C. MARSHALL, JR.
CHIEF OF THE CONSTRUCTION DIVISION
OF THE U. S. ARMY

COL. EVAN SHELBY
IN CHARGE OF THE CONTRACTS DIVISION

COL. PETER JUNKERSFELD

IN CHARGE OF THE BUILDING DIVISION

COL. M. J. WHITSON

COL. C. D. HARTMAN
IN CHARGE OF THE MAINTENANCE DIVISION

COL. J. H. ALEXANDER
IN CHARGE OF THE ADMINISTRATIVE DIVISION

COL. CHARLES NEVILLE
IN CHARGE OF THE ACCOUNTING DIVISION

Engineers of Construction Division

(*Continued from page* 208)

Colonel Whitson—Building Division

Col. M. J. Whitson, assistant to chief of the Building Division, was born in Le Claire, Iowa, in 1878, and was graduated from the University of Illinois in 1902. Before entering the service he was in charge of construction work for Stone & Webster in the Northwest. Seven years ago he joined Grant Smith & Co. on a partnership basis, and later as director in the corporation. He resigned from this concern in June, 1917, in order to become an Army officer.

In the service he helped organize the Cantonment Division and was in charge of the Construction Branch, which was changed to the Building Division when the Construction Division of the army was organized.

Colonel Hartman—Maintenance and Repair

Col. C. D. Hartman, now in charge of the Maintenance and Repair Division, was born in Brookhaven, Miss., in 1886. He was graduated from the United States Military Academy at West Point in 1908, and was assigned to duty with the Third Infantry, Spokane, Wash., for eight months, thence transferred to Seattle in February, 1909, where he remained until July of the same year. He served in Jolo, Philippine Islands, until March, 1912, under General Pershing, during the clean-up of the southern islands.

After being relieved from duty in the Philippines he was stationed at the Madison Barracks, New York, until May, 1916, when he was sent to the border and stationed at Eagle Pass, Tex., until May, 1917. He was then again detailed to the Madison Barracks, in the first officers' training camp. In October, 1917, he was detailed to the Construction Division, and in March, 1918, was made lieutenant colonel and placed in charge of the Maintenance and Repair Division. He was made colonel in June, 1918.

Colonel Alexander—Administrative Division

Col. J. H. Alexander, chief of the Administrative Division, was born in New Haven, Conn., in 1884, and is a graduate of the University of Minnesota and of the Case School of Applied Science. Before entering the service he had wide experience in construction and engineering work as chief engineer of the Municipal Traction Co. of Cleveland, Ohio; assistant general manager of the Pittsburgh Railway Co., Pittsburgh; chief engineer of the City Street Railway Co. of Cleveland, and assistant to the president of the Cleveland Railway Co., Cleveland. In these positions he has handled all phases of engineering construction, management, and administration of large public utilities, and obtained a broad experience in labor and transportation matters.

The Administrative Division establishes and lays down the fundamental standards and policies for the general administration of the division, approves all labor rates, and supervises labor matters and conditions at all projects. In addition, it compiles and keeps a record of labor rates, conditions and agreements, also records of officers assigned to duty with the division, and supervises clerical routine, files, mail and messenger service, and conducts a general information bureau.

Colonel Neville—Accounting Division

Col. Charles Neville, chief of the Accounting Division, was born in New York City in 1875. Before entering the service he was traffic manager of the Stillmore Airline Ry., general freight and passenger agent and auditor of the Coast and Piedmont Ry., vice-president of the Brinson Ry. (now the Savannah & Atlantic Ry.), and subsequently practiced as a public accountant in Savannah, Tampa and Birmingham. He was senior partner of Neville, McIver, Barnes & Co., certified public accountants, and member of the American Institute of Accountants.

In the service he had full charge of policy, organization, commissions, civilian personnel, requests for commissions, travel orders, etc., and acted for the chief of the Construction Division in all accounting matters.

Rainfall and Run-off Committee Appointed

A committee on the standardization of rainfall and run-off measurements was created at a recent meeting of the New England Water-Works Association. The chairman of the committee is William T. Barnes, of Metcalf & Eddy, 14 Beacon St., Boston, Mass. The other members are Robert E. Horton, Albany, N. Y., who suggested the creation of the committee; George A. Carpenter, Sidney K. Clapp, George H. Leland and John L. Howard. A paper on "Measurements and Records of Rainfall and Snow" will be presented by Mr. Horton at the meeting of the association to be held in Boston Feb. 6.

Work Resumed on Welland Canal

Construction operations on the new Welland Canal, which shut down some years ago on account of the war, have been resumed, according to information from the Canadian Department of Railways and Canals. Work is to be taken up at once on Secs. 1, 2, 3 and 5 under a temporary arrangement with the former contractors. These contractors, with their locations, are as follows: Sec. 1, the Dominion Dredging Co., Ltd., Ottawa; Sec. 2, Baldry, Yerburgh & Hutchinson, Ltd., St. Catherine's; Sec. 3, Doheny, Quinlan & Robertson, Montreal; Sec. 5, the Canadian Dredging Co., Ltd., Midland, Ont.

Supreme Court Upholds Ohio Conservancy Act

In a decision on a taxpayer's action against the Miami Conservancy District directors, the United States Supreme Court recently affirmed the constitutionality of the Ohio Conservancy Act, which had been attacked.

The suit was brought in the form of an injunction to restrain the directors from collecting assessments against the property of the plaintiff, W. P. Orr, and other persons in Piqua, who had been declared to be benefited by the construction of the flood-control work. In the United States District Court of Southern Ohio the case was decided against the plaintiff, and the Supreme Court's decision now disposes of the matter finally. It affirms specifically the legality of taxation and expenditures for conservancy purposes within the Miami district. According to the Miami Conservancy *Bulletin* of January, this was the final step in the litigation instituted against the construction of the Miami River flood-protection work.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN WOOD PRESERVERS' ASSOCIATION; F. J. Angier, Mt. Royal Station, Baltimore, Md.; Jan. 28-29, St. Louis.

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Feb. 17-20, New York.

The Cleveland Engineers' Veteran Corps has recently been organized by veteran members of the old 10th Ohio Engineers, which afterward became the 112th Engineers, under Col. John R. McQuigg, and saw service on the Western front. Charles Ollenbacher is temporary chairman and Edward Baxter is secretary.

The American Water-Works Association's nominating committee has named the following candidates for office for the year 1919-20: For president, Carleton E. Davis, Philadelphia; for vice-president, M. L. Worrell, Meridian, Mass.; for treasurer, James M. Caird, Troy, N. Y.; for trustees, District No. 1, W. H. Randall, Toronto, Ont.; District No. 2, F. C. Jordan, Indianapolis, Ind.

The Engineers' Society of Milwaukee held its regular monthly meeting Jan. 15 under the auspices of the Milwaukee

Section of the American Society of Mechanical Engineers. Maj. Henry L. Dale, Corps of Engineers, U. S. A., spoke on "Engineering Experiences at the Front."

The Illinois County Superintendents of Highways will meet at Springfield Feb. 13-15. The short course in highways engineering at the University of Illinois will be held at Urbana Feb. 17-22 in connection with the Springfield meeting. The course is open to any one without examination, and there are no charges. The State Highway Department is giving its coöperation and a number of its engineers will appear on the program.

The North Dakota Society of Engineers will hold its annual meeting at Valley City, Jan. 30-31. E. J. Thomas of Minot is president of the society and E. F. Chandler, of the University of North Dakota, is secretary.

The Kansas Engineering Society will hold its annual meeting at Topeka Jan. 30-31. Con M. Buck, division engineer, Santa Fé Ry., is president of the society and Lloyd B. Smith is secretary.

The Engineers' Club of Trenton will hold a meeting this evening to discuss a plan for acquiring permanent quarters of the club, the policy of the club during the coming year on civic matters, and the matter of an American international submarine cable system as a necessary adjunct to the development of foreign commerce.

The Montreal Branch of the Engineering Institute of Canada held a meeting Jan. 16, at which the following papers were read: "Design and Construction of Reinforced-Concrete Viaducts on the North Toronto Subdivision, Canadian Pacific Ry.," by B. O. Eriksen and S. H. Deubelbeiss, and "Some Problems of National Reconstruction," by W. F. Chipman. A meeting of the branch will be held this evening, and will be addressed by J. A. Burnett on a "Coaling Plant for Locomotives" and by George K. McDougall on "Industrial Illumination." A meeting, to be held Jan. 30, will be devoted to fuel problems; Paul Seurot will speak on "Coal Briquetting" and the R. E. Cleaton Co. will show a motion picture entitled 'Coal Is King."

The South Dakota Society of Engineers and Surveyors will hold its annual meeting at Mitchell Jan. 28. R. E. Easton, of Aberdeen, is secretary of the society.

The Engineers' Society of St. Paul elected the following officers at the meeting held Jan. 13: President, W. C. Armstrong, chief engineer, Union Depot Co.; vice-president, E. V. Willard, drainage engineer of Minnesota; secretary, Paul C. Gauger, engineer and superintendent, George J. Grant Construction Co.; treasurer, George L. Nason, landscape architect.

The Rochester Engineering Society will be addressed Jan. 24 by S. M. Day, of the General Railway Signal Co., who will speak on "Elements of Alternating Current Signaling." The society will hold a meeting Jan. 27, before which Isaac Adler will read a paper on "A League of Nations."

The Engineers' Club of Philadelphia will be addressed by P. H. W. Ross, president of the National Marine League, on "Public Participation in Maritime Development," at the weekly luncheon of the club to be held Jan. 28.

The Springfield Engineers' Club, Springfield, Ill., elected the following officers at the recent annual meeting: President, H. B. Lewis; vice-president, J. Leisenring; secretary, D. A. Henry.

PERSONAL NOTES

Readers who are returning to civil life from military, naval or other Government service are strongly urged to send in items about themselves and about their friends who are in similar situation. Items should give former position, describe character of military or other service and state the civil work to which the engineer or contractor in question is going. In the case of those with service abroad, information regarding the activities of the units to which they were assigned is especially desired.

COL. WILLIAM J. WILGUS, Corps of Engineers, U. S. A., deputy director general of transportation with the American Expeditionary Forces in France, has returned to this country. Colonel Wilgus was formerly vice-president and chief engineer of the New York Central & Hudson River R.R., and before entering the Army had been in consulting practice in New York City.

LIEUT.-COL. A. S. CUSHMAN, who, for 18 months, was in charge of metallurgical and explosives investigations for the Ordnance Department at the Frankford arsenal, has been discharged from the Army and has returned to Washington to assume the directorship of the Institute of Industrial Research, Incorporated.

D. W. MURPHY, drainage engineer, United States Reclamation Service, Los Angeles, has resigned to engage in private practice as consulting engineer, with office in the Hollingsworth Building, Los Angeles, specializing in irrigation and drainage and the care and protection of soils. He has been connected with the Reclamation Service since 1904 and was appointed drainage engineer in 1911.

CHARLES W. STANIFORD has resigned as chief engineer of the Department of Docks and Ferries of New York City to enter consulting practice in dock, port and harbor work. He will be located at 50 Church St., New York, in the same office as B. F. Cresson, with whom he is associated at present in a number of port and harbor studies. Mr. Staniford has been in the dock department of New York for 30 years and has been chief engineer 14 years. In that time he has had charge of such well known dock construction as the Chelsea development on the West Side and the deep cofferdam at the 47th St. piers, also on the North River. During the war he was a member of the committee on port terminals of the Council of National Defense, which planned the storage and terminal facilities for the overseas shipments to the troops in France. He also made the appraisal in 1918 of the German dock property in Hoboken.

MAJ. GEORGE SYKES, Corps of Engineers, U. S. A., has returned to the United States from service overseas and will reëngage in business in New York as head of the George Sykes Co., specialists in the building of country houses. Major Sykes was, until July 1, 1918, executive officer for the chief engineer of lines of communication, and was then placed in charge of the construction of cantonments in rest areas for the advance section.

CAPT. CHARLES F. HEALEY, Corps of Engineers, U. S. A., who was division engineer on the northwest lines of the American railroads of the American Expeditionary Forces in France, has returned to the United States and has been discharged from the Army. He is at present at his home in Goshen, Ind.

A. W. THOMPSON, Federal manager of the Baltimore & Ohio R.R. and associated lines east of Parkersburg and Pittsburgh, has tendered his resignation to the Government, to become president of the Duquesne Light Co. of Philadelphia, and the Philadelphia Co., the public service company of that city. Mr. Thompson was previously chief engineer of the Baltimore & Ohio, and in 1912 was appointed vice-president in charge of operation and afterward vice-president in charge of traffic and commercial development. He became Federal manager of the system last year. He was graduated from Allegheny College in 1897 and entered the service of the Baltimore & Ohio in 1899 as assistant engineer of surveys on the Pittsburgh division. A year later he was

appointed division engineer of the Pittsburgh division. In 1903 he became superintendent of the Cumberland division and later of the Wheeling division. In 1907 he was appointed chief engineer maintenance of way, becoming chief engineer three years later. It is expected that Mr. Thompson will assume his duties as president of the Philadelphia Co. in February.

MAJ. R. S. BUCK, 11th Engineers, U. S. A., has returned from France and has received his discharge from the Army. He will resume his position as engineer maintenance of way of the New York Railways Co.

JACOB LOUIS JACOBS, who has been engaged on special staff work for the United States Shipping Board, Emergency Fleet Corporation, has returned to his work as head of J. L. Jacobs & Co., industrial engineers, Monadnock Building, Chicago.

MORRIS L. COOKE, BOYD FISHER, KEPPELE HALL, HORACE K. HATHAWAY, CLYDE L. KING and JOHN H. WILLIAMS have become associated as consulting engineers in management, with offices in the Finance Building, South Penn Square, Philadelphia.

COL. WILLIAM B. LADUE, 207th Engineers, U. S. A., who recently returned from France, has been appointed district engineer, Delaware River and Bay district, with headquarters in the Witherspoon Building, Philadelphia. He was previously in charge of the Contract Division of the War Department, with the rank of major, and in 1913 was placed in charge of the river and harbor improvements at Jacksonville, Fla.

JOSEPH MELTZER, previously engineer, Casper Ranger Construction Co., Boston, and lately resident manager, United States Housing Corporation, Quincy, Mass., has organized the firm of Joseph Meltzer & Co., engineers and contractors, with office at 31 Beach St., Boston, to engage in general contracting work, specializing in the construction of paper mills and other industrial buildings.

LIEUT. FRANCIS W. DU BOIS, Sanitary Corps, U. S. A., who has been stationed at Selfridge Field, Michigan, as camp sanitary engineer for the past five months, has been discharged from the service and will resume the practice of civil and municipal engineering at an early date. He was previously a member of the firm of Cory and Du Bois, Inc., engineers, Baker, Mont.

H. LOU MILLER, formerly engineer with the duPont Engineering Co., on the construction of the power plant at Nashville, has entered the service of the Portland Cement Association, at Kansas City, Mo.

O. W. CHILDS, senior highway engineer and highway bridge engineer, Bureau of Public Roads, Washington, D. C., has removed to Denver, to become superintendent of the Denver Steel & Iron Works. In 1890 Mr. Childs entered the employ of the Chicago Bridge & Iron Co., remaining in structural work until he entered the Bureau of Public Roads five years ago.

LIEUT. WILLIAM P. DANFORD, 139th Engineers, U. S. A., has received his discharge from the service and has returned to the Oklahoma State Highway Department as district engineer, in which he previously served as assistant state engineer.

R. A. MILLER, F. D. HOLBROOK, and W. D. P. WARREN have become associated under the firm name of Miller, Holbrook, Warren & Co., civil engineers, Decatur, Ill., combining the firms originally known as the Miller-Holbrook Engineering Co. and the Warren Engineering Co. The new firm will specialize in general municipal improvements and reinforced-concrete structures.

HARRISON GRAY OTIS, city manager of Auburn, Me., has resigned to become associated with the American City Bureau, with office in the Tribune Building, New York City. Mr. Otis is secretary of the City Managers' Association.

MAJ. LEWIS E. MOORE, Corps of Engineers, U. S. A., who was in charge of heavy highway bridge work with the American Expeditionary Forces in France, has returned to the United States and has received his discharge, reassuming his connection as engineer of the Massachusetts Public Service Commission.

F. J. WALSH, consulting engineer, Astoria, Ore., who was engineer of sewer construction at Camp Lewis, has been appointed consulting engineer of the Port of Tacoma, Wash., in the development of plans for harbor improvements.

MAJ. MURRAY BLANCHARD, 520th Engineers, has returned from France and has received his discharge from the service. He was formerly connected with the Sanitary District of Chicago.

JAMES A. BUTLER and F. ALBERT HAYES have become associated under the firm name of Butler & Hayes, Inc., experimental engineers and mechanical and chemical consultants, with office and laboratories at 220 Devonshire St., Boston.

JOHN M. MALANG, superintendent of the special road district, Joplin, Mo., has been appointed secretary of the Missouri State Highway Commission.

OBITUARY

ROLLA C. CARPENTER, professor emeritus of experimental engineering, Cornell University, died at his home at Ithaca, Jan. 19. He was born in 1852, and was graduated from the University of Michigan in 1877, after which he served for one year as assistant engineer on the construction of the Detroit & Bay City R.R. From 1878 to 1890 he was professor in charge of the department of mathematics and civil engineering, Michigan Agricultural College. In 1890 he became associate professor of experimental engineering and was in charge of that department at Sibley College, Cornell University. He had engaged in a considerable amount of consulting engineering work, particularly in the installation of water-supplies.

GEORGE SHERWOOD HODGINS, editor of *Railway and Locomotive Engineering*, died in New York, Jan. 18, at the age of 59. He was born in Toronto, and for a number of years was mechanical engineer of the Canadian Pacific Ry. He went to New York about 20 years ago and since then served as an editor of *Gas Age* and *Railway Age*, later becoming associated with *Railway and Locomotive Engineering*, with which he was connected for 15 years.

CHARLES E. VOGDES, engineer, Second District of the Highway Bureau of Philadelphia, died in that city Jan. 12. He entered the service of the Park Commission of the city in 1894 and in 1901 was appointed one of the highway commissioners who later were succeeded by the district engineers in the Highway Bureau.

FREDERICK BROOKS, past president of the Boston Society of Civil Engineers, died in Boston Jan. 10. He was graduated from Harvard in the class of 1868 and afterward took a course at the Massachusetts Institute of Technology. Besides his work in this country, he was at one time engaged on the construction of the Mexican Central R.R. For several years he was secretary of the Association of Engineering Societies, acting also as editor of the *Journal* of the association.

BERNT BERGER, consulting engineer, New York, died in that city Jan. 16. He was born in Norway in 1866 and came to this country in 1886, becoming associated with Theodore Cooper, under whom he served for some time as assistant engineer on various bridge and railway projects. He was engaged in the construction of the Mexican National Ry. shops at Laredo, Tex. Mr. Berger was a past president of the Brooklyn Engineers' Club.

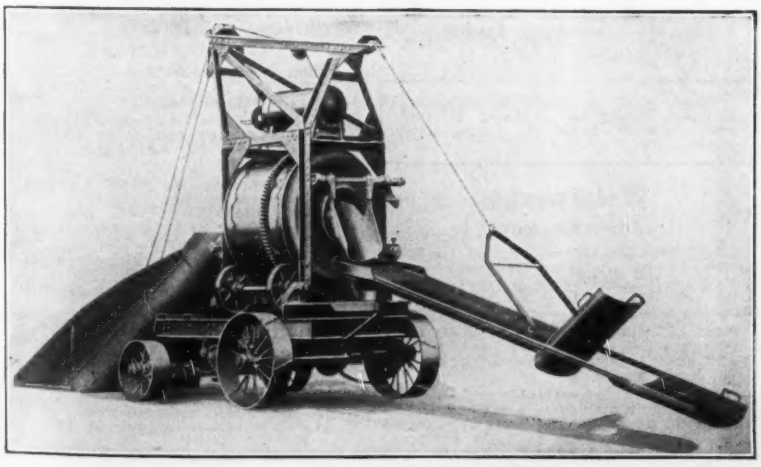
Dunn Wire-Cut-Lug-Brick Patents Are Sustained

The Dunn Wire-Cut-Lug Brick Co., of Conneaut, Ohio, was sustained by the United States Circuit Court of Appeals of the Sixth District in its suit against Joseph Nicholson et al, of Toronto, Ohio, for infringement of its patent number 918,980 dated Apr. 20, 1909, on wire-cut-lug paving bricks. The court affirmed the validity of the patent, declaring it basic and requiring a discontinuance of manufacture and an accounting by the defendant.

The suit grew out of the making and selling by the defendant of wire-cut brick having lugs cut with a knife instead of wires. In rendering its decision the court held that the Dunn brick was a new and useful invention; that its wide, general use aided in establishing its character; that it was an improvement on other wire-cut brick, and was produced by simple means; that the invention was protected by a basic patent, and that the method of cutting the lugs made no difference, since, whether the cutting be done by wire or knife or saw, the methods are equivalent, and the Dunn company is entitled to protection.

Paver That Can Be Used in Alleys as Well as in Streets

A concrete mixer and paver of a new design in which larger capacity is attained without sacrificing compactness, is shown in the accompanying illustration. It is adapted to work in alleys and other tight places as well as to the usual street work. It is 7 ft. 3 in. wide and 14 ft. 4 in. long, with loader down as shown, but without spout. Its height is 11 ft., allowing ample head room for the ordinary bridges and viaducts. It is self-propelled at speeds up to 1½ miles per hour, and has a capacity of 10, cu.ft. dry material per batch, or 8 cu.ft. wet mix. The distributing spout swings in 180° limits, has adjustable pitch and is provided with gates for discharging the concrete in three places. It is manufactured by the Lansing Co., Lansing, Mich.



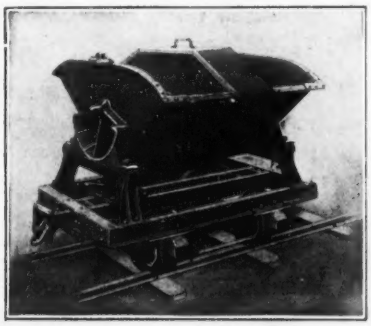
PAVER FOR USE IN RESTRICTED AREAS

Material-Handling Machinery Makers Form Association

Manufacturers of material-handling machinery met in New York Jan. 15-16 to organize an association to promote the development of their products. A temporary organization under the leadership of James A. Shepard, of the Shepard Electric Crane & Hoist Co., was effected. It is expected that the permanent association will be complete in a few days.

Car Measures Correct Amounts for Concrete Mix

A 1-yd. tram car has been designed to hold and convey complete and properly proportioned quantities of concrete material from a central storage or loading plant to the concrete mixer. After the car is loaded with sand and stone it is run past the cement shed where the cement box, which is water-tight,



CAR FOR CONCRETE INGREDIENTS

is filled, either with bulk or bag cement. This makes possible the use of bulk cement on the job exclusively, but if bag cement is used the cement compartment may be employed to return the salvaged bags to storage. When the cars reach the mixer the body is lifted off the running gear, and the complete batch is dumped into the charging skip of the mixer. The cement box is removable, making the car a 1-yd. V-dump, and the entire body may also be removed from the truck, thus converting it into a flat-car on which forms, track or other material may be hauled. The car is manufactured by the Lakewood Engineering Co., Cleveland, Ohio.

BUSINESS NOTES

Walter Snyder, former associate of Frederick A. Waldron, has formed a partnership with Addison G. McKean, under the firm name of Snyder & McKean, industrial and consulting engineers, with offices in the Kinney Building, Newark, N. J.

H. W. Clarke, who was until recently connected with the advertising department of the McGraw-Hill Co. in Chicago, has been appointed manager of advertising for the Chicago Pneumatic Tool Co., Chicago. Mr. Clarke has been identified with the engineering advertising field for several years.

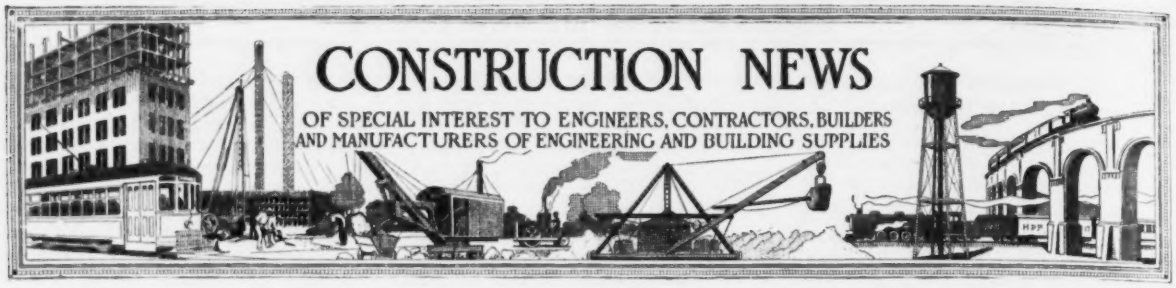
The Whiting Foundry Equipment Co., Marquette Building, Chicago, Ill., whose general office and works are at Harvey, Ill., announces that Samuel Moore, formerly general manager of the Bond plant of the American Radiator Co., succeeds F. A. Rundle as general superintendent, and E. V. Brown and Walter R. Hans, of the company's engineering staff, will be attached to the Chicago office of the company.

First Lieut. C. F. Messinger, chemical warfare section, stationed at Camp Kendrick, Lanehurst, N. J., has been mustered out of service and has returned to his former position as manager of the sales department of the Chain Belt Co., Milwaukee.

TRADE PUBLICATIONS

"Steel Tile Forms" is the title of bulletin 12A issued by the Northwestern Iron Works of Eau Claire, Wis., incorrectly noted in *Engineering News-Record* of Jan. 2, p. 70, due to a typographical error.

"Jeffrey Bucket Elevators" is the title of catalogue No. 244, issued by the Jeffrey Mfg. Co., Columbus, Ohio. The book contains 40 pages, illustrated by half tones and line cuts, and gives other information regarding the styles used in handling materials of all kinds. The book is in pamphlet form, 8½ x 11 in., making it convenient for filing in ordinary letter files.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For Proposals Advertised See Pages 52-54 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Jan. 31	Poteau, Okla. Adv. Dec. 19 and 26.	Dec. 26
Jan. 31	Bradentown, Fla.	Jan. 16
Feb. 3	Maple Heights, O.	Jan. 16

SEWERS

Feb. 1	Lincoln, Neb.	Jan. 23
Feb. 5	Portvue, Pa.	Jan. 16
Feb. 8	Granite City, Ill.	Jan. 23

BRIDGES

Feb. 3	Charlotte Harbor, Fla. Adv. Dec. 19, 26, Jan. 2 and 9.	Jan. 2

STREETS AND ROADS

Jan. 27	Louisiana	Jan. 16
Jan. 27	Nevada	Jan. 9
Jan. 29	New York, N. Y.	Jan. 23
Jan. 30	Crestview, Fla.	Jan. 23
Jan. 31	Ohio	Jan. 16
Feb. 3	Santa Barbara, Cal.	Jan. 23
Feb. 3	Indiana	Jan. 23
Feb. 3	Wichita, Kan.	Jan. 9
Feb. 4	Indiana	Jan. 23
Feb. 5	Indiana	Jan. 23
Feb. 5	Hartville, Mo.	Jan. 23
Feb. 5	Indiana	Jan. 9
Feb. 7	Norton, Kan.	Jan. 23
Feb. 10	Fayetteville, W. Va.	Jan. 16
Feb. 11	Indiana	Jan. 23
Feb. 11	Moulton, Ala.	Jan. 16
Feb. 17	Philippi, W. Va. Adv. Jan. 23.	Jan. 23
Feb. 18	Indiana	Jan. 23
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 20	Hamlin, W. Va.	aJn. 23
Feb. 20	Rumson, N. J. Adv. Jan. 23.	Jan. 23
Mar. 4	Ripley, W. Va.	Jan. 23

EXCAVATION AND DREDGING

Jan. 27	Madison, S. D.	Jan. 9
Feb. 3	Madisonville, Ky. Adv. Dec. 5, 12 and 19.	Dec. 12
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 19	Albany, N. Y. Adv. Jan. 23.	Jan. 23

INDUSTRIAL WORKS

Jan. 28	New York, N. Y.	Jan. 9
Jan. 28	New York, N. Y.	Jan. 23
Feb. 3	New York, N. Y.	Jan. 23
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Mar. 4	Thiells, N. Y.	Jan. 16
Apr. 1	Sioux City, Ia.	Jan. 16

BUILDINGS

Jan. 24	Detroit, Mich.	Jan. 23
Jan. 25	Asbury Park, N. J.	Jan. 9
Jan. 27	Hillsboro, Kan.	Jan. 23
Jan. 28	Phila., Pa.	Jan. 23
Jan. 29	West New York, N. J.	Jan. 23
Jan. 30	Phoenix, Ariz.	Jan. 2
Jan. 30	Eagle, Neb.	Jan. 16
Feb. 1	Irvington, N. J.	aJn. 23
Feb. 3	Melbourne, Fla.	Jan. 9
Feb. 3	St. Paul, Minn.	Oct. 31
Feb. 3	Leavenworth, Kan.	Jan. 23
Feb. 5	Portland, Mich.	aJn. 23
Feb. 11	Lusk, Wyo.	Jan. 23
Feb. 14	Brooklyn, N. Y.	aJn. 23
Feb. 24	Norwood, O.	Jan. 23
Mar. 1	Duluth, Minn.	Jan. 23
Mar. 3	Rockport, Ind.	—Jan. 23
Mar. 15	Culver, Ind.	Dec. 26
Apr. 2	New York, N. Y.	Jan. 23

FEDERAL GOVERNMENT WORK

Jan. 27	Extending Pneumatic Tube System, etc.—Spec. 3658—Hampton Roads, Va.	Jan. 16
Jan. 27	Heating Hangar—Spec. 3748—Anacostia, D. C.	Jan. 16
Jan. 27	Gas Holder, Removing System, etc.—Spec. 3594—North Ft. Worth, Tex.	Jan. 16
Jan. 28	Dredging—Key West, Fla. Adv. Jan. 2 and 9.	Jan. 2
Feb. 3	Dredging — Spec. 3579 — Ft. Lafayette, N. Y.	Jan. 16
Feb. 3	Kitchen Equipment—Spec. 3730—Chelsea, Mass.	Jan. 16
Feb. 3	Water Tower, Pump and Tank House Equipment—Spec. 3682 — Philadelphia, Pa.	Jan. 16
Feb. 4	Boilers—Memphis, Tenn. Adv. Jan. 9.	Jan. 9
Feb. 4	Turbine, Pumpset, etc. — Memphis, Tenn. Adv. Jan. 9	Jan. 9
Feb. 10	—Metal and Glass—Baltimore, Md. —. Adv. Jan. 16.	Jan. 16
Feb. 10	Portland Cement — Denver, Colo.	Jan. 23
Feb. 11	Bridge—Washington, D. C. Adv. Jan. 16.	Jan. 16
Feb. 12	Elevator, etc. — Ft. Worth, Tex. Adv. Jan. 23.	Jan. 23
Feb. 15	Laboratory — Washington, D. C. Adv. Jan. 23.	Jan. 23
Feb. 21	Dredging, etc. — Norfolk, Va. Adv. Jan. 23.	Jan. 23
Feb. 25	Jetty Work—Sabine Pass, Tex. Adv. Jan. 23.	Jan. 23
Mar. 1	Foundation and Rip Rap—Baltimore, Md. Adv. Jan. 16.	Jan. 16
Mar. 1	Dredging—Superior, Wis.	Jan. 16

MISCELLANEOUS

Feb. 3	Dam—Los Angeles, Cal.	Jan. 9
Feb. 11	Boilers and Piping, etc. — Utica, N. Y.	Jan. 23
Feb. 14	Additional Window Guards—Bedford Hills, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 14	Pier—Phila., Pa. Adv. Jan. 23.	Jan. 23
Feb. 19	Gantry Crane — Seattle, Wash. Adv. Jan. 2 and 9.	Jan. 2

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

Waterworks

PROPOSED WORK

Mass., Danvers—Town applied to State Legislature for authority to borrow $200,000 to rebuild and relay watermains, improve storage, pumping and distributing facilities.

Mass., Fitchburg—City applied to State Legislature for authority to borrow $300,000 to extend present water-works system. F. H. Foss, mayor.

Mass., Watertown—(Middlesex P. O.)—Metropolitan Water & Sewer Comn., Ashburton Pl., Boston, asked State Legislature for authority to issue $115,000 bonds to build mains, pipe lines, conduits, etc., and provide additional water supply from southern high service for Watertown and Belmont Twps.

Md., Princess Anne—Town Comrs. plan to build water distribution system including 1 or more wood stave tanks, installing gasoline pump and laying terra cotta and c.i. pipe. About $60,000. C. Laukford, pres. L. J. Houston, Fredericksburg, Va., engr.

Minn., St. Paul—City plans to build 7 mi. concrete conduit 7 ft. diameter, to carry water from Lake Vadnais to McCarron Lake. About $300,000. O. Claussen, city engr.

Kan., Hiawatha—Comrs. Brown Co. having plans prepared for new water supply pump house, pumps and about 2 mi. pipe and transmission lines. About $25,000. Black & Veatch, Interstate Bldg., Kansas City, Mo., engrs. Noted Dec. 26.

Okla., Miami—City plans to build rein.-con. reservoir, 12 x 85 x 145 ft. deep with 1,500,000 gal. capacity. R. Q. James, city clk.

Ore., Astoria—Capital Issues Com. granted permission to Astoria Water Comn. to sell $50,000 bonds to complete high service reservoir. A. Johnson, supt.

Cal., Hayward—City retained Olmsted & Gillelen, engrs., 1112 Hollingsworth Bldg., Los Angeles, to prepare plans and submit estimate for water works system.

Cal., Pittsburg—City retained Olmsted & Gillelen, engrs., 1112 Hollingworth Bldg., Los Angeles, to prepare plans and submit estimate for water works system.

Cal., Sacramento—City election Apr. 30, to vote on $1,200,000 bonds for water filtration plant. F. C. Miller, city engr.

Ont., Peterborough—Utilities Comn. purchased site at north end of city and plans to build filtration plant.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract.)

Mich., Detroit—H. S. Starkey, secy. water comn., 232 Jefferson Ave., received bids Jan. 14, furnishing 1000 tons 6 in. c. i. pipe and 1000 tons 8 in. c. i. pipe, from Amer. Cast Iron Pipe Co., 512 1st Natl. Bank Bldg., U. S. Cast Iron Pipe Co., 122 South Michigan Blvd., J. B. Clew & Son, Harrison St. Bridge. Contractors all of Chicago and each bid $63.60 per ton. Noted Jan. 9.

★**Mich., Wyandotte**—City let contract furnishing and laying 1450 ft. submerged intake pipe and elbows equipped with flanges and joints, removal of existing elbow, relocating existing crib, final testing, dredging and backfilling and all labor and material involving 1450 ft. 24 in. c. i. pipe, to A. Q. Thatcher Constr. Co., 8 Marine Bldg., Toledo, O. About $37,500. Noted Jan. 9.

Sewers

PROPOSED WORK

Conn., Bridgeport—City plans to build sewers in east end section. About $300,000. J. A. McElroy, city engr.

Pa., Scranton—City receives bids in June building sewerage system in 21st Ward. About $165,000. W. A. Schunk, city engr. Noted Aug 15.

Ia., Davenport—City plans to build 400 ft. 66 in. storm drain sewer and 1300 ft. tunnel in Blackhawk Creek Dist. About $100,120. R. E. Sawistowsky, city engr.

Ark., Hot Springs—City soon lets contract building sewers in Sewer Impvt. Dist. No. 40, 6 in. mains, cost, $4200; also in Impvt. Dist. No. 43, 6 and 8 in. mains, $9000. F. A. Stearns, comr.

Tex., Dallas—City plans to build 1300 ft. monolithic concrete and tile pipe storm sewer in Grand Ave., from Oakland to Meyers Sts., cost, $7766; 800 ft. 30 in. rein.-con. sewer in Oakland Ave. from Forest Ave. to South Blvd., $4040; 12,000 ft. 30-60 in. monolithic concrete pipe and 15 to 24 in. tile sewer in Douglas St. Dist., $70,150; 1500 ft. 15-24 in. tile pipe sewer in Fair Park, $8941. G. D. Fairtrace, city engr.